5-4120-362-13

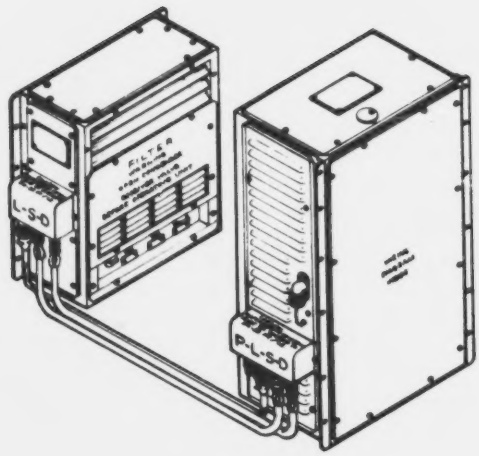
TECHNICAL MANUAL

TM 5-4120-362-13

OPERATOR'S, ORGANIZATIONAL AND DIRECT SUPPORT MAINTENANCE MANUAL

AIR CONDITIONER: WALL OR BASE MOUNTED, SELF-CONTAINED, MULTI-PACKAGE, STANDARD WEIGHT, AIR COOLED, 6,000 BTU/HR COOLING, 4,000 BTU/HR HEATING, CLASS 1 115 VOLT, SINGLE PHASE, 2-WIRE, 50/60 HERTZ MODEL CE-6A-60

KECO MODEL F6000-7
NSN 4120-01-066-9677



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HEADQUARTERS, DEPARTMENT OF THE ARMY
21 NOVEMBER 1980

D 101.11:

WARNING

HIGH VOLTAGE

is used in the operation of this equipment
DEATH ON CONTACT
may result if personnel fail to observe safety precautions

Never work on electronic equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas.

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it.

Be careful not to contact high-voltage connections of 115 volts ac input when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through vital organs of the body.

Do not operate the equipment without grilles, louvers, and covers in place and tightly secured.

Warning: Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

WARNING

The burning of polyurethane foams is dangerous.

Due to the chemical composition of a polyurethane foam, toxic fumes are released when it is burned or heated. If it is burned or heated indoors, such as during a welding operation nearby, you should take care to ventilate the area thoroughly. An exhaust system like that of a paint spray booth should be used.

Air-supplied respirators, approved by the National Institute for Occupational Safety and Health or the US Bureau of Mines, should be used for all welding in confined spaces and in places where ventilation is inadequate.

Persons who have chronic or recurrent respiratory conditions, including allergies and asthma, should not work in this area.

WARNING

Clean parts in a well ventilated area.

Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly.

Dry cleaning solvent (Fed. Spec. P-D-680) used to clean parts is potentially dangerous to personnel and property.

Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 50°C).

Wear eye protection when blowing solvent from parts. Air pressure should not exceed 30 psig (2.1 kg/cm^2).

WARNING

REFRIGERANT UNDER PRESSURE

is used in the operation of this equipment.
DEATH
or severe injury may result if you fail to observe safety precautions.

Never use a heating torch on any part that contains Refrigerant R-12.

Do not let liquid refrigerant touch you, and do not inhale refrigerant gas.

WARNING

DANGEROUS CHEMICAL

is used in this equipment
DEATH
or severe damage may result if personnel fail to observe safety precautions.

Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin- eye-contact is possible.

Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

WARNING

EQUIPMENT DAMAGE

may be caused if unit is operated prior to opening of condenser receiver valve.

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable, and their vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well-ventilated area, wear gloves, and keep away from sparks or flames.

WARNING

Compressed air used for cleaning purposes will not exceed 30 PSI.

TECHNICAL MANUAL
TM 5-4120-362-13

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 21 November 1980

OPERATOR'S, ORGANIZATIONAL AND DIRECT SUPPORT MAINTENANCE MANUAL

AIR CONDITIONER: WALL OR BASE MOUNTED, SELF-CONTAINED, MULTI-PACKAGE, STANDARD WEIGHT, AIR COOLED, 6,000 BTU/HR. COOLING, 4,000 BTU/HR HEATING, CLASS 1 115 VOLT, SINGLE PHASE, 2-WIRE, 50/60 HERTZ

REPORTING OF ERRORS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications) or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support & Aviation Materiel Readiness Command, Attn: DRSTS-MTT, 4300 Goodfellow Boulevard, St. Louis, Mo. 63120. A reply will be furnished to you.

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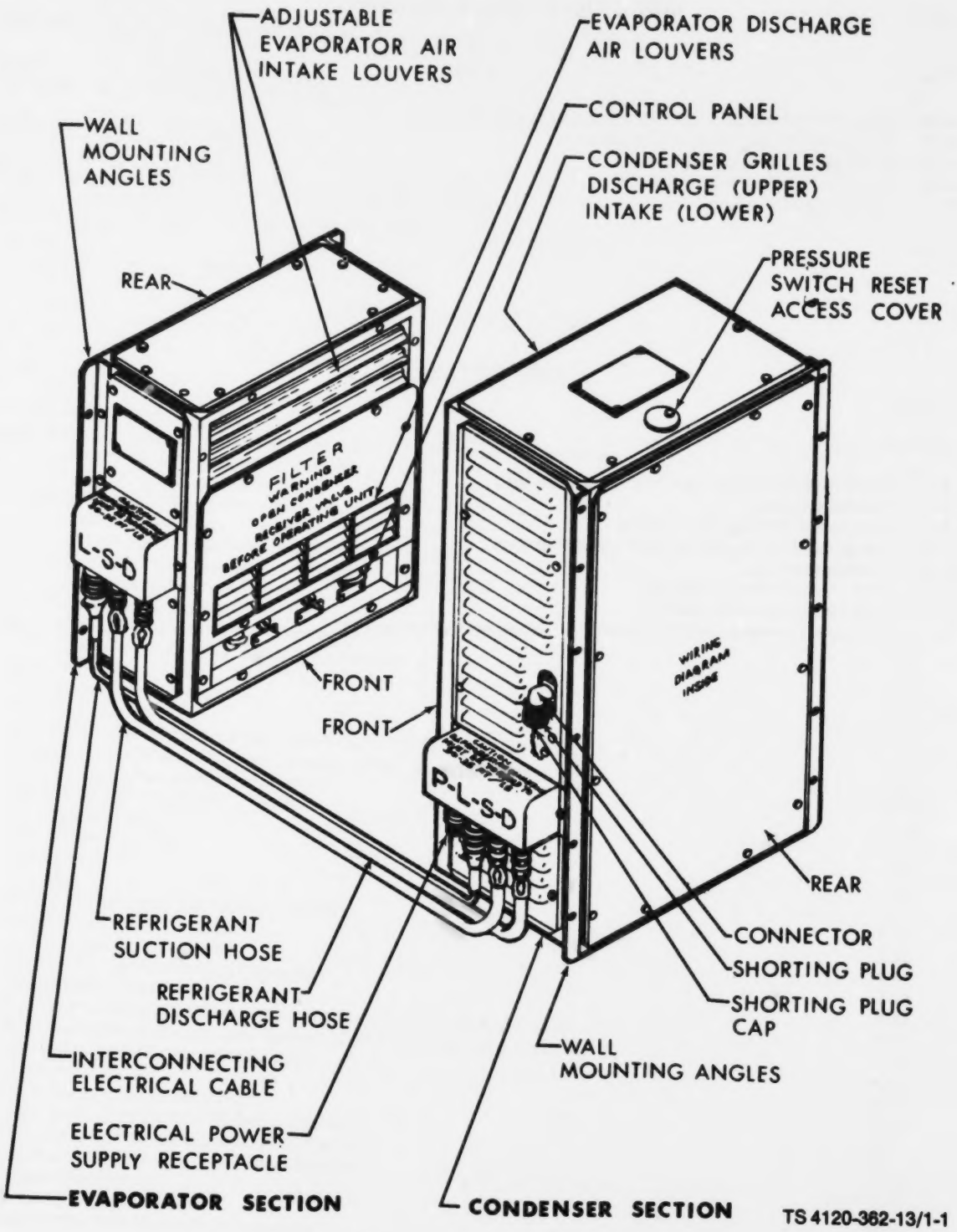

Figure 1-1. Air Conditioner.

CHAPTER 1

INTRODUCTION

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General Information	I
Scope	1-1
Maintenance Forms and Records	1-2
Reporting Equipment Improvement Recommendations (EIR's)	1-3
Equipment Description and Data	II
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Section I.

GENERAL INFORMATION

1-1. SCOPE

a. This manual contains information on the operation, servicing and maintenance of the Model F6000-7 self-contained multi-package, air conditioner (figure 1-1) manufactured by Keco Industries, Inc., Cincinnati, Ohio. Chapters 1 through 3 comprise operating and servicing instructions for the operator. Chapter 4 comprises maintenance instructions concerning mechanical and electrical components for Organizational Maintenance personnel. Chapter 5 provides repair and replacement instructions to be used by Direct Support Maintenance personnel.

b. The purpose of the air conditioner is to provide cooled or heated air to maintain adequate working temperatures for efficient operation of electronic equipment and for the comfort of operating personnel.

1-2. MAINTENANCE FORMS AND RECORDS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM38-750, the Army maintenance Management System (TAMMS).

HAND RECEIPT MANUAL. Hand receipts for the End Item/Components of End Item COEI), Basic Issue Items (BII), and Additional Authorization List (AAL) items are published in a Hand Receipt Manual. The Hand Receipt Manual numerical designation is the same as the related Technical Manual with the letters HR added to the number. These manuals are published to aid in property accountability and are available through: Commander, US Army Adjutant General publication Center, ATTN: AGDL-OD, 1655 Woodson Road, St. Louis, Mo. 63114.

1-3. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR's)

If your air conditioner needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Tell us why a procedure is hard to perform. Put it on a SF 368 (Quality Deficiency Report). Mail it to us at Commander, Headquarters, U.S. Army Troop Support and Aviation Materiel Readiness Command, ATTN: DRSTSMEM, 4300 Goodfellow Blvd., St. Louis, Missouri, 63210. We'll send you a reply.

Section II.

EQUIPMENT DESCRIPTION AND DATA

1-4. PURPOSE OF EQUIPMENT

The F6000-7 Air Conditioner is a multi-package, air cooled, electric motor driven unit. It is designed specifically to provide selected environmental conditioning in air transportable shelters and mobile, van type trucks and trailers for efficient operation of electronic equipment and for the comfort of operating personnel.

1-5. CAPABILITIES AND FEATURES

Major Components:

a. Evaporator Section

(1) Control Panel

(2) Adjustable air intake louvers

(3) Evaporator fan and motor

(4) Air filter

(5) Evaporator coil

(6) Expansion valve

(7) Heater coil

(8) Adjustable discharge air louvers

b. Condenser Section

(1) Intake air grille

(2) Discharge air grille

(3) Intake fixed louver panel

(4) Condenser fan and motor

(5) Compressor

(6) Condenser coil

(7) Receiver

(8) Sight glass liquid indicator

c. Interconnecting electrical cable and refrigerant hoses.

Features.

a. Self-contained

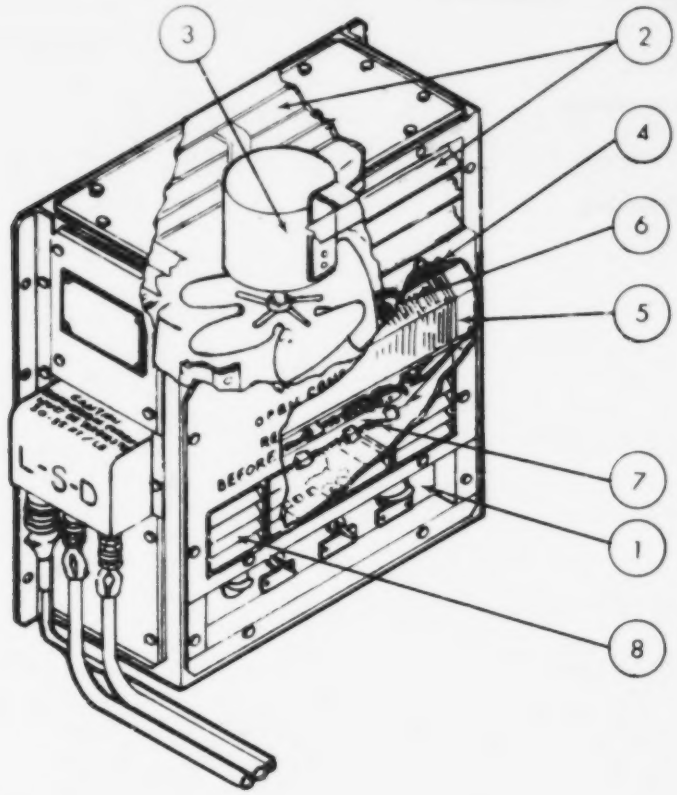
b. Multi-package

c. Easily air transportable

d. 6000 BTU/HR cooling

e. 4000 BTU/HR heating

1-6. LOCATION AND DESCRIPTION OF MAJOR EVAPORATOR SECTION COMPONENTS



CONTROL PANEL (1). Contains the following controls; main power on-off switch, heat-vent-cool switch, warm-cool thermostatic switch, and the fresh and return air louver control.

ADJUSTABLE AIR INTAKE LOUVERS (2). Allows fresh, return or any combination of air intake. These louvers are mechanically controlled from a knob on the control panel.

EVAPORATOR FAN AND MOTOR (3). Pulls air in thru intake louvers and blows air across filter, evaporator coil, and heater coil to discharge air louvers.

AIR FILTER (4). Removes dust, dirt and other airborne debris from the air.

EVAPORATOR COIL (5). Consists of a copper tube coil and aluminum fin assembly with appropriate mounting flanges. Removes heat from the air by transferring it to the refrigerant.

EXPANSION VALVE (6). Controls refrigerant flow to the evaporator coil.

HEATER COIL (7). Consists of an electric resistance coil used to add heat to the air passing over it.

ADJUSTABLE AIR LOUVERS (8). Directs conditioned air. Pull out and turn to desired directional position.

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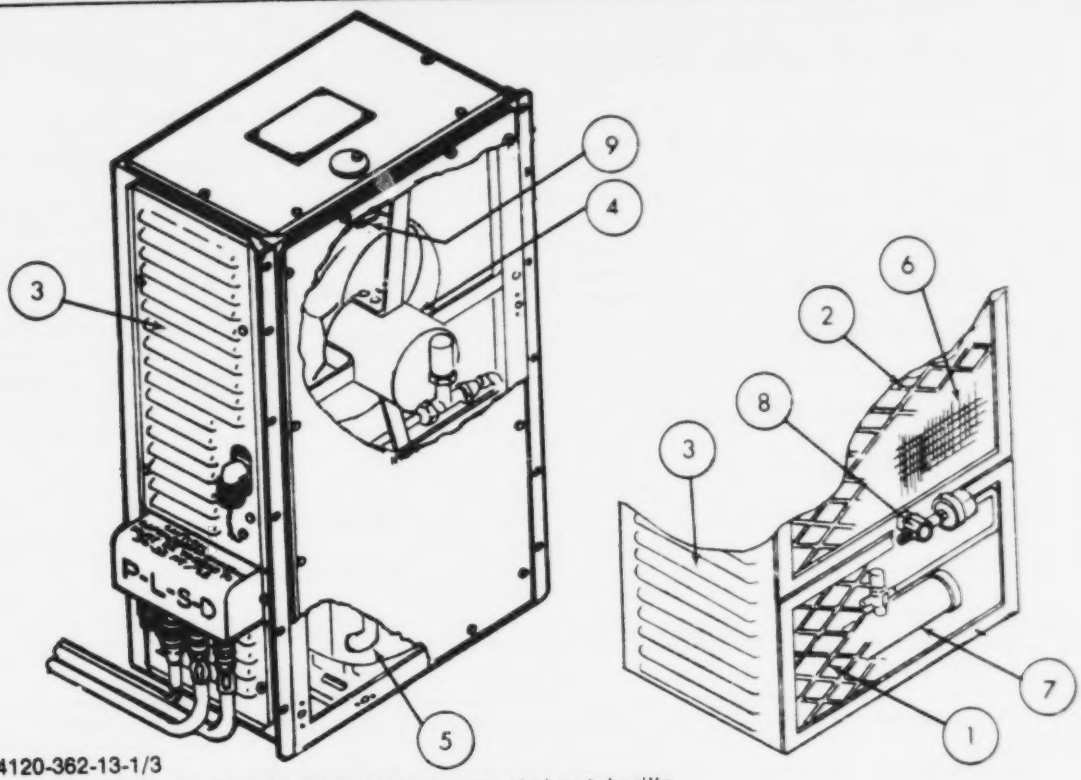
Figure 1-2. Evaporator Section, Location and Description of Major Components.

1-7. LOCATION AND DESCRIPTION OF MAJOR CONDENSER SECTION COMPONENTS



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INTAKE AIR GRILLE (1). Consists of protective expanded metal grille.

DISCHARGE AIR GRILLE (2). Consists of a protective expanded metal grille.

INTAKE AIR FIXED LOUVER PANEL (3). Consists of formed sheet metal louvered panels.

CONDENSER FAN AND MOTOR (4). Pulls air in thru intake grille and fixed louver panels and blows air across condenser coil.

COMPRESSOR (5). Consists of a reciprocating compressor driven by an electric motor hermetically sealed into a steel container.

CONDENSER COIL (6). Consists of a copper tube coil and aluminum fin assembly with appropriate mounting flanges. Removes heat from the refrigerant by transferring it to the air.

RECEIVER (7). Consists of a steel container for collecting the high pressure liquid refrigerant from the condenser coil.

SIGHT-GLASS LIQUID INDICATOR (8). The condition of the liquid refrigerant flowing thru the system can be seen thru this window when the compressor is operating in the cooling mode.

PRESSURE SWITCH (9). If the refrigerant pressure exceeds the maximum set point for the switch, an electrical connection is opened to stop the compressor. Must be manually reset.

Figure 1-3. Condenser Section, Location and Description of Major Components.

1-8. DIFFERENCES BETWEEN MODELS

This manual covers only the Keco Industries, Inc., Model F6000-7 Air Conditioner. No known difference exists for the models covered by this manual.

1-9. PERFORMANCE DATA

OPERATING TEMPERATURES	
Cooling	60°F (+16°C) to +125°F (+52°C)
Heating	-65°F (-54°C) to +80°F (+27°C)
PERFORMANCE	
Cooling Capacity	5800 BTU/HR
Heating Capacity	4000 BTU/HR
WEIGHTS AND DIMENSIONS	
Evaporator Section	
Height	18 inches (45.72 cm.)
Width	8-1/2 inches (21.59 cm.)
Length	17-5/16 inches (44.3 cm.)
Weight	35 pounds (15.75 kg.)
Condenser Section	
Height	26 inches (66 cm.)
Width	9-1/4 inches (23.5 cm.)
Length	17-9/16 inches (44.6 cm.)
Weight	95 pounds (42.75 kg.)
Shipping Weight	140 pounds (62 kg.)
POWER REQUIRED	
Voltage	115
Phase	Single
Hertz	50/60
REFRIGERANT	
Type	R-12
Charge	2.5 pounds (1.14 kg.)

CHAPTER 2

OPERATING INSTRUCTIONS

Section/Paragraph

Description and Use of Operator's Controls and Indicators I
Operator's Controls and Technical Principles of Operation 2-1
Preventive Maintenance Checks and Services (PMCS) II
General 2-2
Operation Under Usual Conditions III
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Operation at High Altitudes 2-14
Emergency Procedures 2-15
Administrative Storage 2-16

Section I.

DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

2-1. OPERATOR'S CONTROLS AND TECHNICAL PRINCIPLES OF OPERATION

a. Control Panel. The control panel is located on the evaporator section below the discharge louver. It contains the following operating controls. See figure 2-1.

(1) Switch 1. Switch 1 is marked SW1, FRESH AIR, 0-100% and controls the mixture of fresh and return air that is supplied to the evaporator system. It is a mechanical device which acts through a wire cable to position the interlocked fresh and return air louvers. Since both louvers operate from a single control, when one is open, the other is closed. Both can be partly open.

(2) Switch 2. Switch 2 is marked SW2, OFF-ON. This is the unit's main power switch. When set in the OFF position the components of the air conditioner are inoperative and deenergized. In the ON position, the evaporator fan operates and the components of the air conditioner function in accordance with the settings of switches 3 and 4.

(3) Switch 3. Switch 3 is marked SW 3, HEAT, VENT, COOL and is the system selector switch. When Switch 2 is in the ON position, Switch 3 operates as follows:

(a) Set to HEAT, the evaporator fan motor operates and the electric heaters are energized, the condenser fan and compressor motors do not operate. Note that Switch 4 must be adjusted to a warm temperature setting.

(b) Set to VENT, the evaporator fan motor operates, but neither heating nor cooling takes place.

(c) Set to COOL, when cooling is required, the evaporator fan, condenser fan, and compressor motors operate and the electric heater is deenergized. When the return air temperature is below the set point of Switch 4 and no cooling is required, the evaporator fan motor continues to operate. The condenser fan and compressor motors do not operate and the electric heaters are deenergized. Note that Switch 4 must be adjusted to a cool temperature setting.

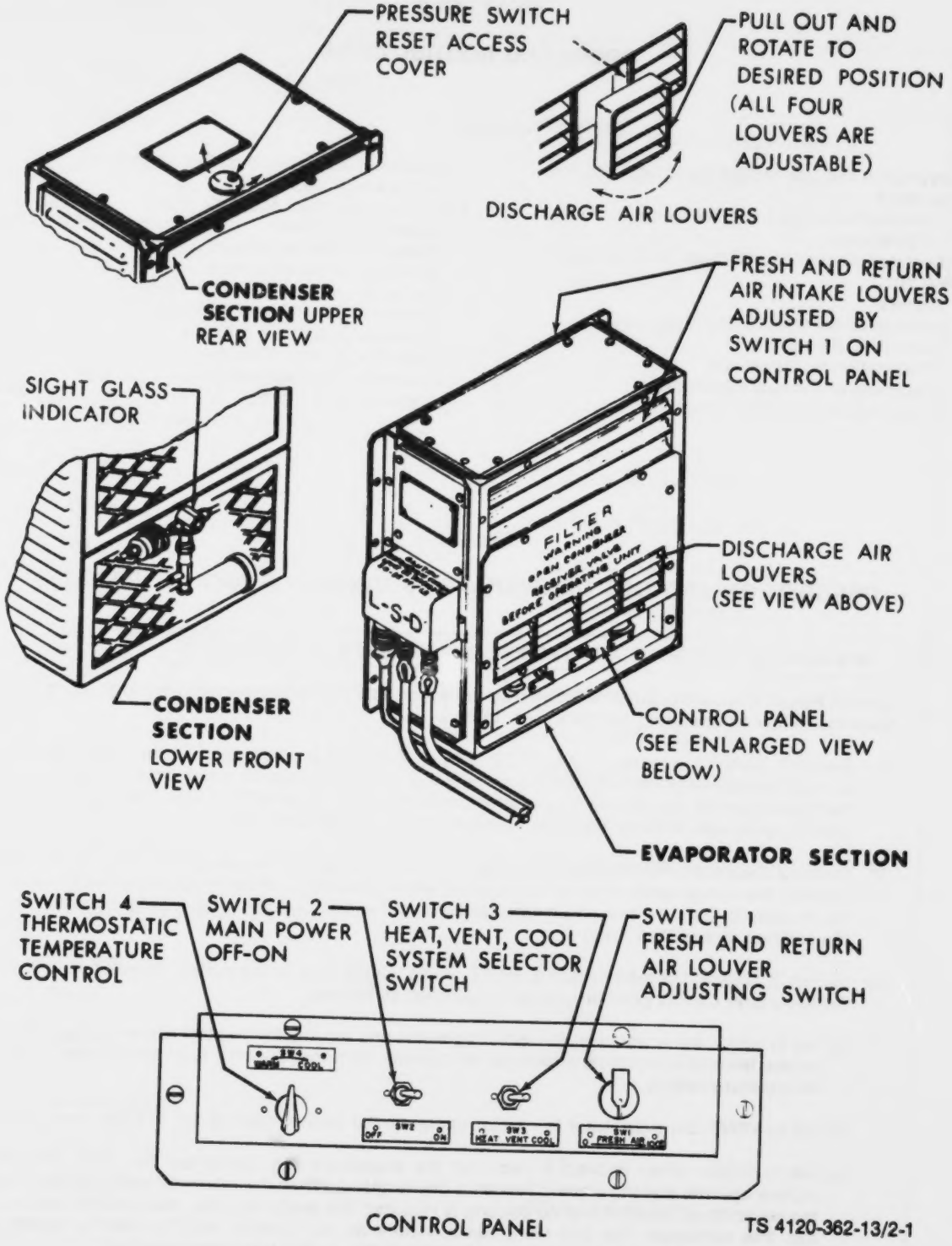
PRESSURE SWITCH RESET ACCESS COVER
PULL OUT AND ROTATE TO DESIRED POSITION (ALL FOUR LOUVERS ARE ADJUSTABLE)
DISCHARGE AIR LOUVERS
CONDENSER SECTION UPPER REAR VIEW
FRESH AND RETURN AIR INTAKE LOUVERS ADJUSTED BY SWITCH 1 ON CONTROL PANEL
SIGHT GLASS INDICATOR
DISCHARGE AIR LOUVERS (SEE VIEW ABOVE)
CONDENSER SECTION LOWER FRONT VIEW
CONTROL PANEL (SEE ENLARGED VIEW BELOW)
EVAPORATOR SECTION
SWITCH 4 THERMOSTATIC TEMPERATURE CONTROL
SWITCH 2 MAIN POWER OFF-ON
SWITCH 3 HEAT, VENT, COOL SYSTEM SELECTOR SWITCH
SWITCH 1 FRESH AND RETURN AIR LOUVER ADJUSTING SWITCH
CONTROL PANEL
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Figure 2-1. Operator's Controls and Indicators

Cooling Cycle. The cooling cycle begins when the controls are set as follows:

- Switch SW3 set to COOL.
- Switch SW2 set in the ON position.
- Switch SW4 set below the return air temperature.

See refrigeration diagram figure 2-2. The liguid refrigerant in the evaporator coil (E) changes to a vapor. This change from liquid to vapor absorbs heat from the air directed over the outside surfaces of the evaporator coil by the evaporator fan, thereby cooling the air. The vaporized refrigerant is piped from the evaporator coil (E) through the line shut off valve (V2) to the compressor (B2) where it is compressed and its temperature again rises. The compressed vapor is then piped to the condenser coil (C) where air passes over the outside surfaces of the coil driven by the condenser fan. The cooler air extracts the heat of evaporation and compression from the vapor recondensing it to a liquid. The liquid flows to the receiver (R) where it is collected under high pressure. Then it flows through the filter-drier (D) and the sight glass (G) to the expansion valve (V1) which meters the refrigerant into the evaporator coil to repeat the cycle.

(4) Switch 4. Switch 4 is marked SW4, WARM-COOL and is a thermostatic switch which controls the heating and cooling elements of the system. The temperature is maintained, within the limits of the unit's capacity, at the switch setting valve. The temperature sensing bulb is attached in the return air stream.

b. Airflow Controls. Airflow is controlled by the proper adjustment of louvers on the evaporator section.

(1) Adjustable Evaporator Air Intake Louvers. These louvers are located on the front and back of the evaporator section toward the top. If the installation allows it, fresh air may be supplied to the evaporator system as well as return air. SW1 controls the mixture by positioning the interlocked air louvers.

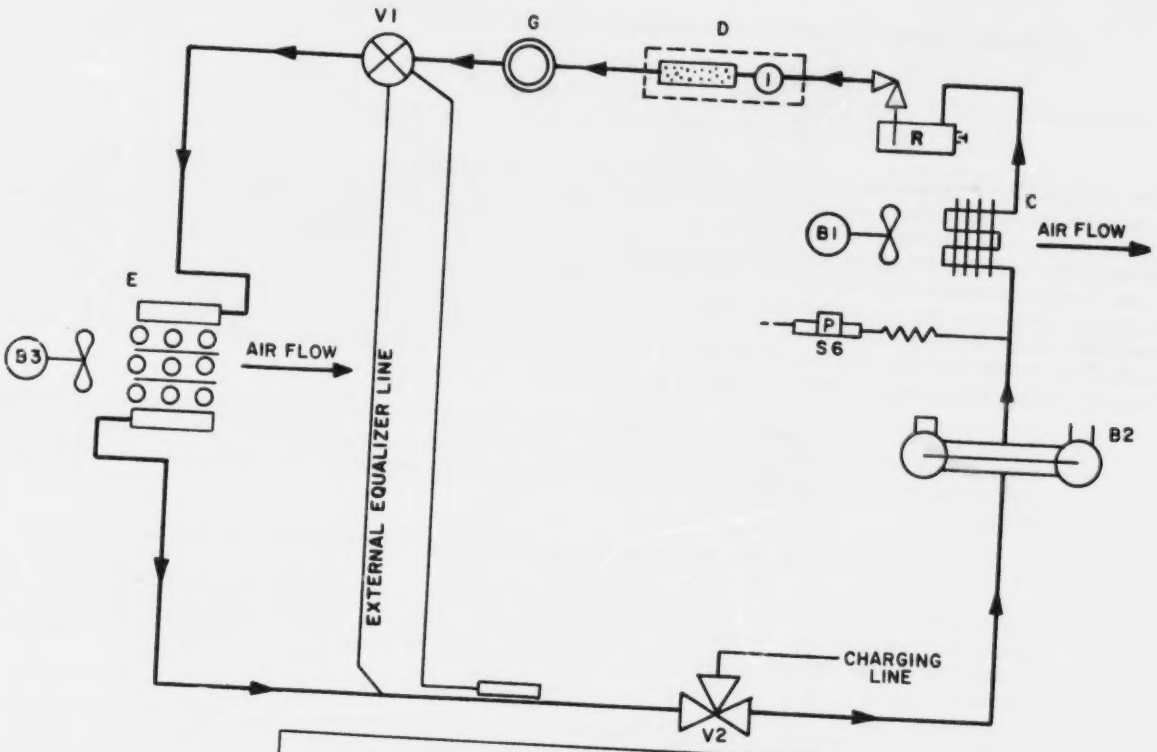
(2) Evaporator Discharge Air Louvers. These louvers located above the control panel on the evaporator section are always open. They provide limited control of the direction of airflow. Each of the four louver assemblies may be rotated in 90° increments. This is done by first pulling the assembly toward the operator on its spring held retainer, turning it and allowing it to spring back in place. See figure 2-1.

NOTE

Cool air is denser than warm air and tends to sink downward. Therefore, it is usually desirable to direct cool air upward and warm air downward for maximum comfort and coverage.

c. Resettable Automatic Controls. There is one automatic control that can stop the air conditioner. It is the high pressure cutout switch which deenergizes the air conditioner when the condensing pressure reaches 325± 10 psig (22.85± 0.07 Kgm/Cm^2). It is mounted in the condenser section toward the top. Access is obtained by rotating the pressure switch access cover so that the reset button is exposed. See figure 2-1. Press and release the button to reset the switch. If ineffective, report the trouble to organizational maintenance.

d. Indicator. The sight-glass indicator is the only indicator incorporated in the air conditioner. See figure 2-1. This circular window into the refrigerant liquid shows the condition of the refrigerant and should be inspected periodically as directed in Table 2-1. The bullseye in the center of the sight glass should be pure green. If chartreuse (yellow-green) or yellow colors are indicated, the refrigerant contains moisture If the sight glass shows a milky or bubbly appearance, the refrigerant is low. Both conditions should be reported to direct support maintenance.



LEGEND	
REF DESIGNATION	DESCRIPTION
B1	FAN MOTOR, CONDENSER
B2	COMPRESSOR
B3	FAN MOTOR, EVAPORATOR
R	RECEIVER WITH OUTLET VALVE AND FUSIBLE PLUG
D	FILTER DRIER
G	SIGHT GLASS
V1	VALVE, EXPANSION
C	COIL, CONDENSER
E	EVAPORATOR
V2	VALVE, LINE SHUT OFF
S6	SWITCH, PRESSURE

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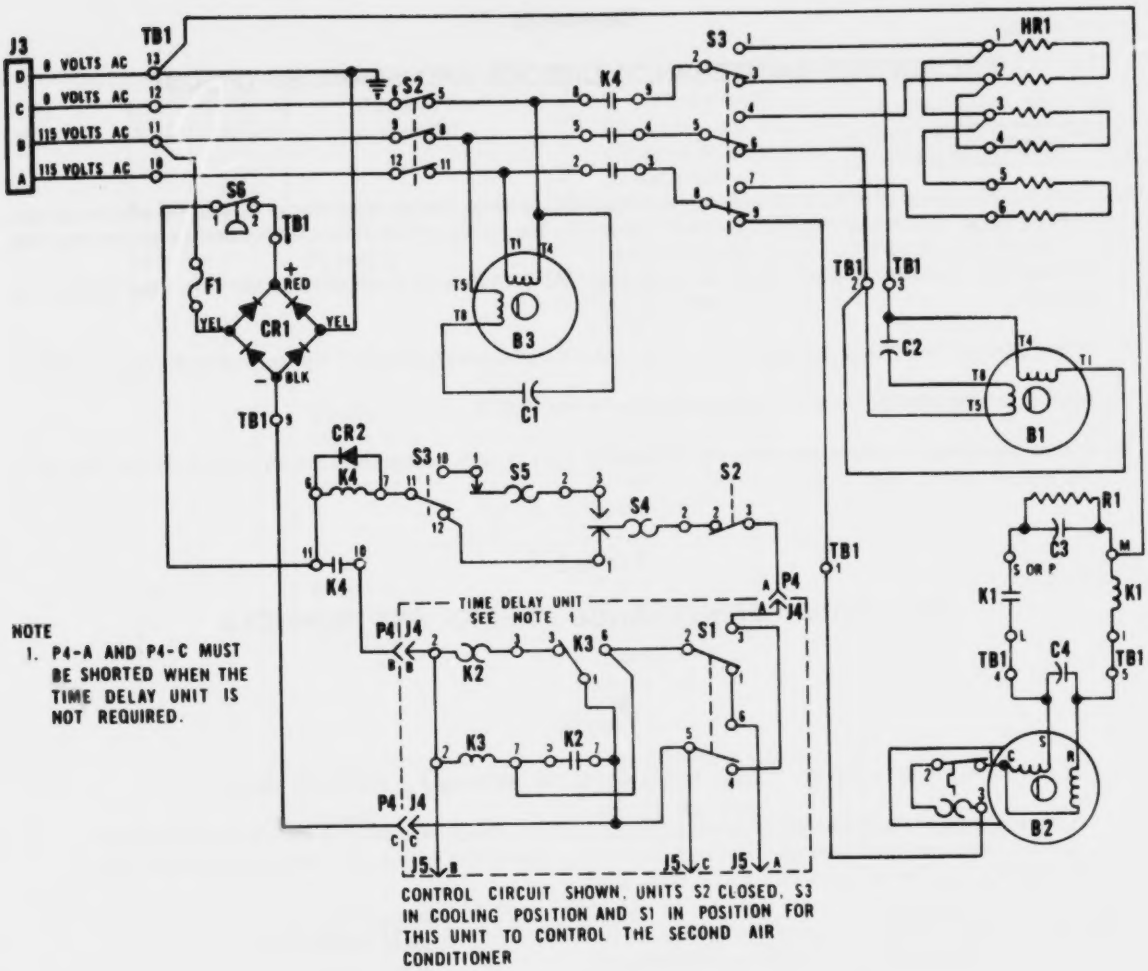
Figure 2-2. Refrigeration Schematic.



LEGEND							
SYM	NAME	SYM	NAME	SYM	NAME	SYM	NAME
B1	MOTOR	F1	FUSE	K3	RELAY	S2	SWITCH,TOGGLE
B2	COMPRESSOR	HR1	COIL,HEATER	K4	RELAY	S3	SWITCH,TOGGLE
B3	MOTOR	J1	CONNECTOR,90°	P1	CONNECTOR	S4	CONTROL, THERMOSTAT
C1	CAPACITOR, MOTOR RUN	J2	CONNECTOR	P2	CONNECTOR	S5	THERMOSTAT
C2	CAPACITOR, MOTOR RUN	J3	CONNECTOR	P3	CONNECTOR	S6	SWITCH PRESSURE
C3	CAPACITOR	J4	CONNECTOR	P4	CONNECTOR	TB1	TERMINAL BOARD
C4	CAPACITOR	J5	CONNECTOR	P5	CONNECTOR	XK2	SOCKET
CR1	RECTIFIER	J7	CONNECTOR	P6	CONNECTOR	XK3	SOCKET
CR2	RECTIFIER, JCT, SILICON	K1	RELAY	P7	CONNECTOR	XK4	SOCKET
		K2	RELAY,THERMAL TIME DELAY	P8	SHORTING PLUG		
				R1	RESISTOR		
				S1	SWITCH,TOGGLE		

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Figure 2-3. Electrical Schematic

Section II.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-2. GENERAL

Preventive maintenance checks and services are required to keep the air conditioner operating efficiently and to prevent damage caused by neglect. Table 2-1 contains the listing of periodic checks and services required.

a. **Before you operate.** Always keep in mind the CAUTIONS and WARNINGS. Perform your before (B) PMCS.

b. **While you operate.** Always keep in mind the CAUTIONS and WARNINGS. Perform your during (D) PMCS.

c. **After you operate.** Be sure to perform your after (A) PMCS.

d. **If your equipment fails to operate.** Troubleshoot with proper equipment. Report any deficiencies using the proper forms, see TM 38-750.

Table 2-1.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES

NOTE

Within designated intervals, these checks are to be performed in the order listed.

If the equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B — Before
D — During
A — After
W — Weekly
M — Monthly

TABLE 2-1 (cont)

Item No.	Interval B	D	A	W	M	Items to be Inspected	Procedures. Check for and have repaired or adjusted as necessary.	For readiness reporting. Equipment is not ready/ not available if:
1	•					Panels & hoods	Check for loose mountings or damage. See figure 1-1	Panels and hoods are missing
2	•					Condenser intake and discharge grilles	Inspect for loose mounting, obstructions and general condition. See figure 1-3	Grilles are missing
3	•					Evaporator Adjustable air intake louvers	Inspect for loose mounting, obstructions and general condition. See figure 1-2	Louvers are missing
4	•					Interconnecting cable and hoses	See that connectors make firm and secure contact. See figure 1-1	
5		•				Refrigerant sight glass. See figure 2-1	After 15 minutes of operation in maximum cooling, check for bubbles or milky flow indicating low refrigerant charge. Check for yellow color which indicates presence of moisture. Observe through opening in condenser intake grille.	Bubbles, milky flow or yellow color is observed
6		•				Control panel operating controls. See figure 2-1	Inspect for damage, secure mounting and proper operation.	Control panel is damaged or operating improperly

Section III.

OPERATION UNDER USUAL CONDITIONS

2-3. OPERATING PROCEDURE

a. All modes of operation are controlled from the control panel on the evaporator section. Output airflow is controlled by the discharge louvers in the evaporator section and do not require readjusting, except when a different pattern of coverage is desired or to accommodate the heating or cooling mode. See paragraph 2-1b.

WARNING

Open condenser receiver valve before operating unit.

CAUTION

Make sure shorting plug and cap are in place. See figure 1-1.

b. Starting the unit.

(1) Check to see that instructions of paragraphs 2-5, 2-6, 4-4 and 4-5 Assembly and Preparation for Use and Initial Adjustment and Checks, have been carried out.

(2) Adjust SW1 for desired fresh air and return air mixture.

(3) Set SW3 to VENT position.

(4) Set SW2 to ON position.

c. Cooling Operating Instructions.

(1) Set SW3 to COOL position.

(2) Adjust SW4 for desired temperature.

d. Heating Operating Instructions.

(1) Set SW3 to HEAT position.

(2) Adjust SW4 for desired temperature.

e. Ventilation Operating Instructions.

(1) Adjust SW1 for desired fresh air and return air mixture.

(2) Set SW3 to VENT position.

(3) Set SW2 to ON position.

f. Normal Shutdown. To shut down the air conditioner, turn SW2 to OFF position.

2-4. PREPARATION FOR MOVEMENT

When the unit is to be moved, the services of organizational maintenance shall be employed for the necessary preparations. See Chapter 4, Section VI.

2-5. ASSEMBLY AND PREPARATION FOR USE

Services of organizational maintenance should be employed for original unpacking, assembly installation and preparation for use. See paragraphs 4-4 and 4-5.

2-6. INITIAL ADJUSTMENTS AND CHECKS

a. Inspect all panels, hoods, grilles and louvers for loose mounting, obstructions or shipping damages. See that all interconnecting cables and hoses are properly in place and that connections are tight. Make sure that there are no kinks and that the installation has not created a tripping hazard. Inspect control panel for visual damage and loose mountings. Report any deficiencies to organizational maintenance.

b. Perform the preventive maintenance checks and services listed in Table 2-1.

2-7. OPERATING INSTRUCTIONS ON DECALS AND INSTRUCTION PLATES

a. The unit does not contain a step by step instruction plate or decal.

b. See figure 2-4 for evaporator section stencils and instruction plates.

c. See figure 2-5 for condenser section stencils and instruction plates.

Section IV.

OPERATION UNDER UNUSUAL CONDITIONS

2-8. GENERAL INFORMATION

The air conditioner is designed to operate normally within a wide range of climatic conditions. However, some extreme conditions require special operating and servicing procedures to maintain high efficiency and minimize wear.

2-9. OPERATION IN EXTREME COLD

The air conditioner is designed to operate in temperatures as low as 0° F (-18°C) in the cooling mode and in temperatures as low as -65° (-54°C) in the heating mode.

CAUTION

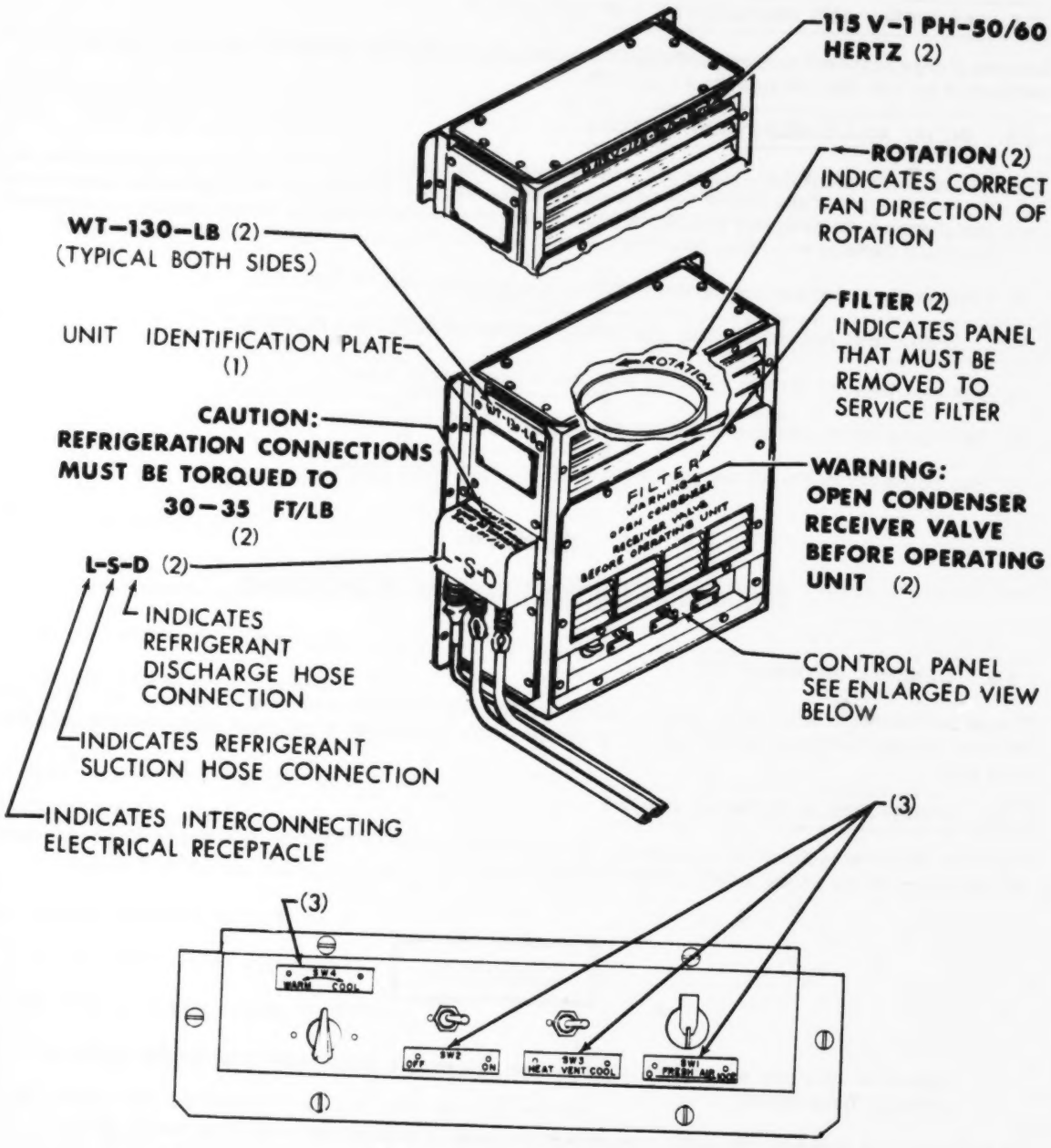
Operation of either evaporator or condenser fan motors below -65°F (-54°C) can result in damage to equipment.

At extremely low temperatures, extra care should be taken to reduce heat loss of the enclosure by:

a. Weather-stripping windows and doors.

b. Insulating surfaces exposed to the outside.

c. Limiting the amount of outside air drawn in through the fresh air louver of the evaporator. Do not disturb wiring during extremely cold weather. Wire and insulation become brittle, and are easily broken.


115 V-1 PH-50/60 HERTZ (2)
ROTATION (2) INDICATES CORRECT FAN DIRECTION OF ROTATION
WT-130-LB (2) (TYPICAL BOTH SIDES)
FILTER (2) INDICATES PANEL THAT MUST BE REMOVED TO SERVICE FILTER
UNIT IDENTIFICATION PLATE (1)
CAUTION: REFRIGERATION CONNECTIONS MUST BE TORQUED TO 30-35 FT/LB (2)
WARNING: OPEN CONDENSER RECEIVER VALVE BEFORE OPERATING UNIT (2)
L-S-D (2)
INDICATES REFRIGERANT DISCHARGE HOSE CONNECTION
CONTROL PANEL SEE ENLARGED VIEW BELOW
INDICATES REFRIGERANT SUCTION HOSE CONNECTION
INDICATES INTERCONNECTING ELECTRICAL RECEPTACLE
(3)
(3)
SW4 WARM COOL
SW2 OFF ON
SW3 HEAT VENT COOL
SW1 FRESH AIR

CONTROL PANEL VIEW

(1) INDICATES METAL PLATE
(2) INDICATES STENCIL
(3) INDICATES PLASTIC PLATE

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Figure 2-4 Evaporator Section Stencils and Instruction Plates.

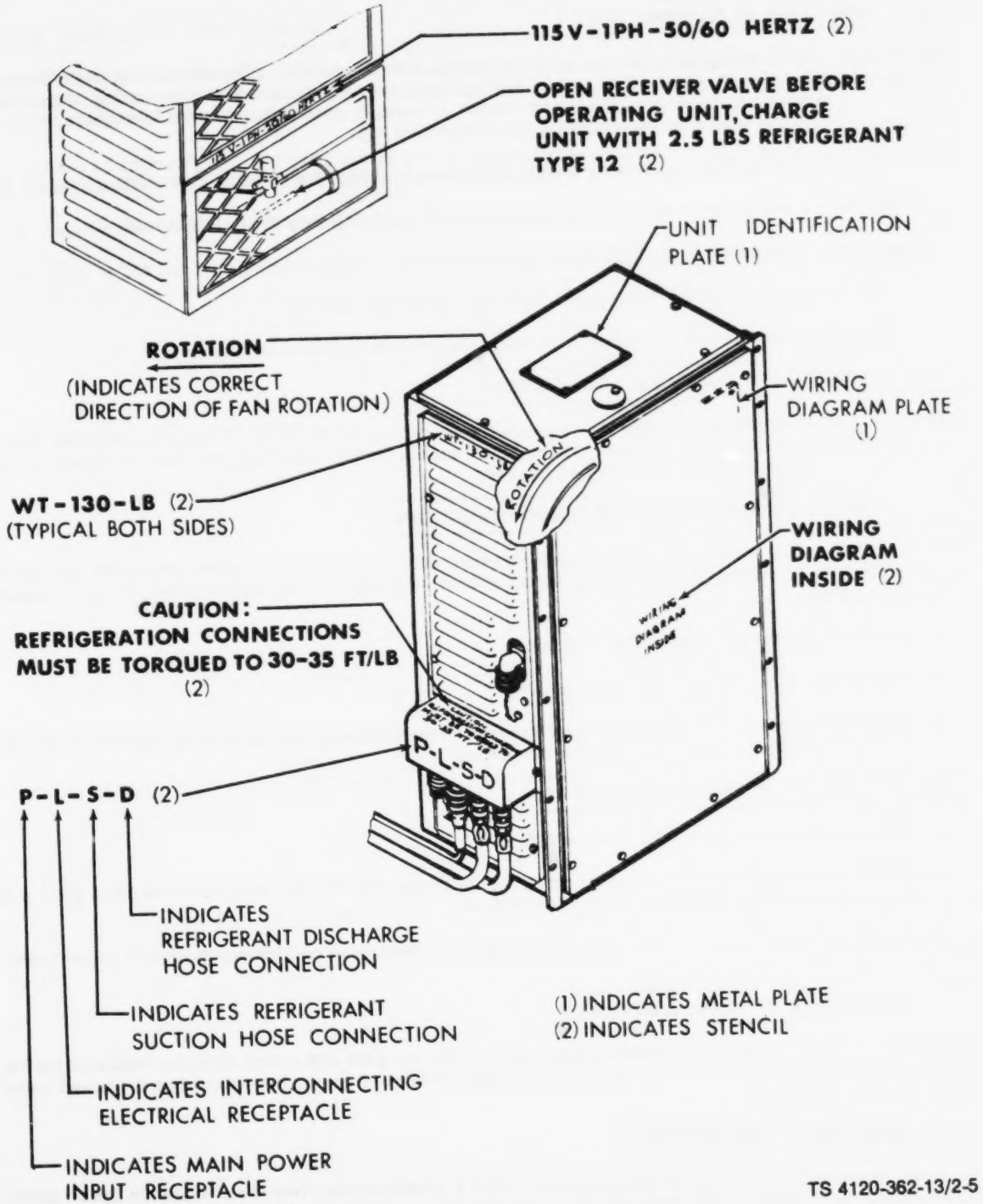
115V-1PH-50/60 HERTZ (2)
OPEN RECEIVER VALVE BEFORE OPERATING UNIT, CHARGE UNIT WITH 2.5 LBS REFRIGERANT TYPE 12 (2)
UNIT IDENTIFICATION PLATE (1)
ROTATION
(INDICATES CORRECT DIRECTION OF FAN ROTATION)
WIRING DIAGRAM PLATE (1)
WT-130-LB (2)
(TYPICAL BOTH SIDES)
WIRING DIAGRAM INSIDE (2)
CAUTION:
REFRIGERATION CONNECTIONS MUST BE TORQUED TO 30-35 FT/LB
(2)
P-L-S-D (2)
INDICATES REFRIGERANT DISCHARGE HOSE CONNECTION
INDICATES REFRIGERANT SUCTION HOSE CONNECTION
INDICATES INTERCONNECTING ELECTRICAL RECEPTACLE
INDICATES MAIN POWER INPUT RECEPTACLE
(1) INDICATES METAL PLATE
(2) INDICATES STENCIL
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Figure 2-5. Condenser Section Stencils and Instruction Plates.

2-10. OPERATION IN EXTREME HEAT

The air conditioner is designed to operate in temperatures up to 125°F (52°C). Although it is not recommended, the unit can be operated above 125°F (52°C) during emergency conditions. However, as the temperature increases, a reduction in cooling capacity and related increase in power requirements take place. This will continue until the overload devices protecting the compressor trip.

At extremely high temperatures, extra care should be taken to reduce the cooling load of the enclosure by:

a. Checking openings such as doors and windows to be sure that they are tightly closed.

b. Using window shades to shut out direct rays of the sun.

c. Limiting the use of electric lights and other heat producing equipment.

d. Limiting the introduction of outside air through the fresh air louver of the evaporator.

2-11. OPERATION IN DUSTY OR SANDY AREAS

Sand, dust, dirt, smoke, soot and other debris can seriously reduce the efficiency of the air conditioner. Where this contamination is a problem, it is essential that the frequency of maintenance performed by organizational maintenance on the coils, filter and fans be increased.

2-12. OPERATION UNDER RAINY OR HUMID CONDITIONS

The air conditioner is reasonably weatherproof, however, during periods of extremely wet, windy and humid weather, the following precautions should be observed to provide maximum protection to the unit and to assure efficient operation:

a. Shield all air inlet and outlets from the rain.

b. Keep all electrical components clean and dry.

c. Increase the frequency of maintenance performed by organizational maintenance on the coils, drain tube and outer surfaces under these extreme conditions.

2-13. OPERATION IN SALT WATER AREAS

a. Keep all electrical components clean and dry.

b. Increase the frequency of maintenance performed by organizational maintenance on the coils, drain tube and outer surfaces under these extreme conditions.

c. Exposed areas should be spray-rinsed or sponged with clear water periodically to remove salt encrustations.

2-14. OPERATION AT HIGH ALTITUDES

There are no special instructions regarding operation and servicing the unit at high altitudes. However, the frequency of maintenance performed by organizational maintenance on the air filter should be increased under these extreme conditions.

2-15. EMERCENCY PROCEDURES

To conserve available power during periods when full 115 V, single phase power is not available, the air conditioner should be operated in the ventilate mode only. Do not operate under 90 volts.

2-16. ADMINISTRATIVE STORAGE

a. Store equipment so as to provide maximum protection from the elements and to provide access for inspection, maintenance and servicing. Anticipate removal or deployment problems, and take suitable precautions.

b. Take into account environmental conditions, such as extreme cold or heat, high humidity, blowing snow, earthquakes, or combinations thereof, and take adequate precautions.

c. Establish a fire plan, and provide for adequate precautions.

d. Refer to TM 740-90-1 (Administrative Storage of Equipment) for detailed information on Administrative Storage.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTIONS

Section I.

LUBRICATION INSTRUCTIONS

3-1. GENERAL

The compressor is hermetically sealed, with a charge of oil included. The condenser fan and evaporator fan motors incorporate sealed bearings, so that no lubrication is required. When necessary to relieve binding of louver blades, fasteners, etc., an application of light machine oil may be worked into the joint or pivot. Excess oil should be blotted up with a cloth or paper towel.

Section II.

TROUBLESHOOTING

3-2. USE OF TABLE

The Troubleshooting Table 3-1 contains information useful in diagnosing and correcting unsatisfactory operation or failure of the air conditioner.

a. Table 3-1 lists the common malfunctions which you may find during the operation or maintenance of the air conditioner or its components. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by listed corrective actions, notify your supervisor.

c. Any trouble or corrective action beyond the scope of operator maintenance shall be reported to organizational maintenance.

TABLE 3-1 — TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. AIR CONDITIONER DOES NOT START
Check to be sure main power cable is connected.
Connect power cable.
2. COMPRESSOR FAILS TO START
Step 1. Check switch SW3 for COOL setting.
Place switch SW3 in COOL position.
Step 2. Check if switch SW4 is not set at low enough temperature.
Turn switch SW4 clockwise.
3. INSUFFICIENT COOLING
Step 1. Check evaporator air intake and outlet louvers to make sure they are open, not obstructed, and able to provide adequate air output.
Open or remove obstruction.
Step 2. Check thermostatic temperature control switch SW4 setting.
Set thermostat at maximum clockwise COOL setting.
Step 3. Check sight glass liquid indicator for bubbles.
If bubbles exist, report condition to organizational maintenance.
4. REDUCED HEATING CAPACITY
Step 1. Check thermostatic temperature control switch SW4 setting.
Set thermostat at maximum counterclockwise WARM setting.
Step 2. Check switch SW1 air louver adjusting switch.
Adjust to admit less cold fresh air.
5. LOUVERS FAIL TO OPERATE
Step 1. Check linkage for possible binding.
Report to organizational maintenance.
Step 2. Check for foreign object in louver blades.
Remove foreign object from louver blades.
6. HEATER FAILS TO OPERATE WHEN EVAPORATOR FAN OPERATES
Step 1. Check if switch SW3 is in HEAT position.
Place switch SW3 in HEAT position.
Step 2. Check if switch SW4 is not set at warm enough temperature.
Turn switch SW4 counterclockwise.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

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Preparation For Storage or Shipment VI

Section I.

REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

4-1. GENERAL

a. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

b. No special tools are required for maintenance of the equipment. Test, maintenance and diagnostic equipment (TMDE) and support equipment include standard pressure and vacuum gages, vacuum pump and charging manifolds found as standard equipment in any refrigeration shop.

c. Repair parts are listed and illustrated in the Repair Parts and Special Tools (RPSTL) list TM 5-4120-362-23P covering organizational and direct support maintenance for this equipment.

Section II.

SERVICE UPON RECEIPT OF EQUIPMENT

4-2. UNPACKING

a. Carefully remove air conditioner from crate or material used to ship it, including plastic wrapping. Also separate interconnecting hoses and cable from packing.

b. If evaporator and condenser sections are bolted together, separate them.

c. Remove protective dust caps from receptacles.

d. Unplug interconnecting hoses.

e. Set sections in upright position for checking.

4-3. CHECKING UNPACKED EQUIPMENT

Check the air conditioner in accordance with the following instructions:

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on DD Form 6, Packaging Improvement Report.

b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of TM 38-750.

c. Check to see whether the equipment has been modified.

d. Inspect entire air conditioner for missing or loose hardware or any defects that may have occurred during shipment.

e. Thoroughly check to see that all wiring, lines and tubing are secure. Especially inspect the evaporator and condenser coils and main power receptacle connector.

f. Be sure all visible wiring and insulation is not frayed or broken.

g. Check the evaporator and condenser fan motors for free rotation.

4-4. INSTALLATION INSTRUCTIONS

Observe the following requirements and recommendations when installing the air conditioner.

a. Select a site with the following requirements.

(1) The air conditioner must have an unobstructed flow of air in order to operate efficiently. Make use of terrain features, trees and buildings if possible to provide a shaded location. This minimizes the cooling load on the refrigeration system.

(2) Try to place the unit so that prevailing winds do not blow toward the face of the condenser unit.

(3) Do not locate the condenser unit where intake air is likely to be laden with dust, dirt, soot, smoke or other debris.

(4) Location of the evaporator section is determined by the internal layout of the enclosure to be conditioned and the length of interconnecting hoses. As far as possible, locate the unit so that the conditioned air discharges toward the area most critically in need of cooling. Discharge direction can be controlled somewhat by adjustment of the discharge louvers. The installation should alow access to

the front of the unit to change the filter and use the controls. Fresh air intake is through the back of the unit so a hole will have to be made in the enclosure's wall. Once the locations for each unit have been selected, some compromise may have to be made due to the restrictive 60 inch (150 cm) length of hoses and cable. Before mounting, make sure there will be an adequate flow of air to and from each unit.

(5) The unit should be located as near as possible to a source of 115-volt, single phase, 50/60 hertz, ac electric power. The electrical power supply receptacle is located on the condenser section (figure 1-1).

b. The evaporator and condenser sections are designed for wall or floor mounting. See Table 4-1 and figures 4-1 and 4-2.

TABLE 4-1 — INSTALLATION DRILLING INSTRUCTIONS

Type of Mounting	Condenser Section	Evaporator Section
Floor	Drill four 0.50 in. (1.27 cm) diameter holes per figure 4-1. Use four .3125-24 UNF (length as required) bolts for mounting.	Drill four 0.50 in. (1.27 cm) diameter holes per figure 4-1. Use four .3125-24 UNF (length as required) bolts for mounting. Drill two 0.69 in. (1.75 cm) diameter drainage holes.
Wall	Drill ten holes for 0.25 in. (0.63 cm) diameter bolts or lag screws per figure 4-2.	Drill eight holes for 0.25 in. (0.63 cm) diameter bolts or lag screws per figure 4-2.

c. The evaporator section section should be mounted on a level supporting surface. If a level surface is not obtainable, the unit may be mounted at an angle no greater than five degrees from the horizontal.

d. Two drain connections are located on the evaporator section drain pan. If the unit is placed so that drain lines are necessary, they are to be connected per the following instructions:

(1) Connect a drain line to both drains if possible. If this is not possible connect to the lowest of the two drains.

(2) Use standard .25-18 NPT fittings to connect to the drains in the pan.

(3) Using tubing, rigid pipe or hose, direct the condensate water to an existing drain, storm sewer or dry sump.

e. Connections between the condenser and evaporator sections.

(1) Connect the larger refrigerant hose to the fittings marked S. Use two wrenches, one to hold the fitting on the unit stationary, and the other to tighten the coupling to approximately 35 foot pounds (47.8 newton meters) of torque.

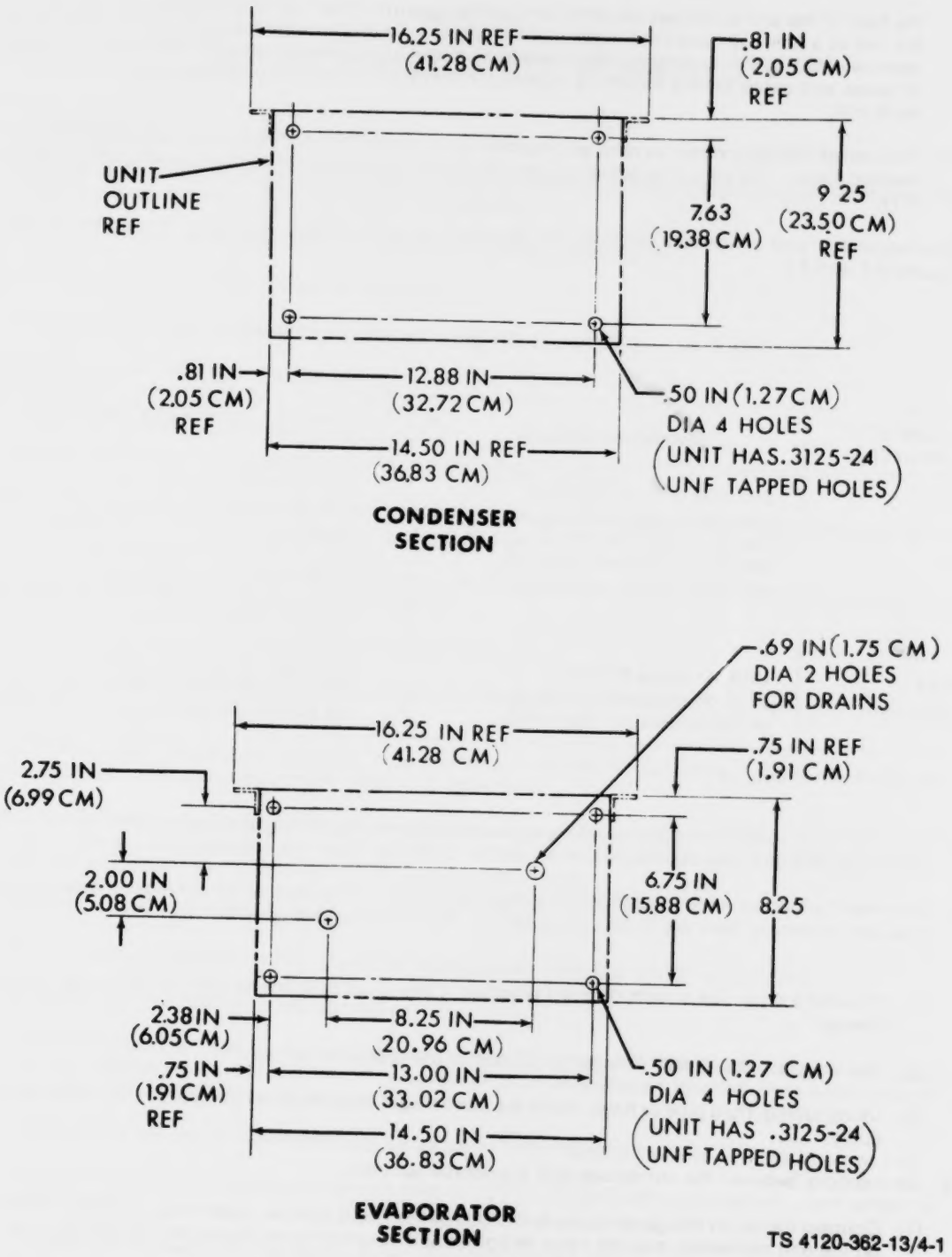

Figure 4-1. Floor Mounting Diagram.

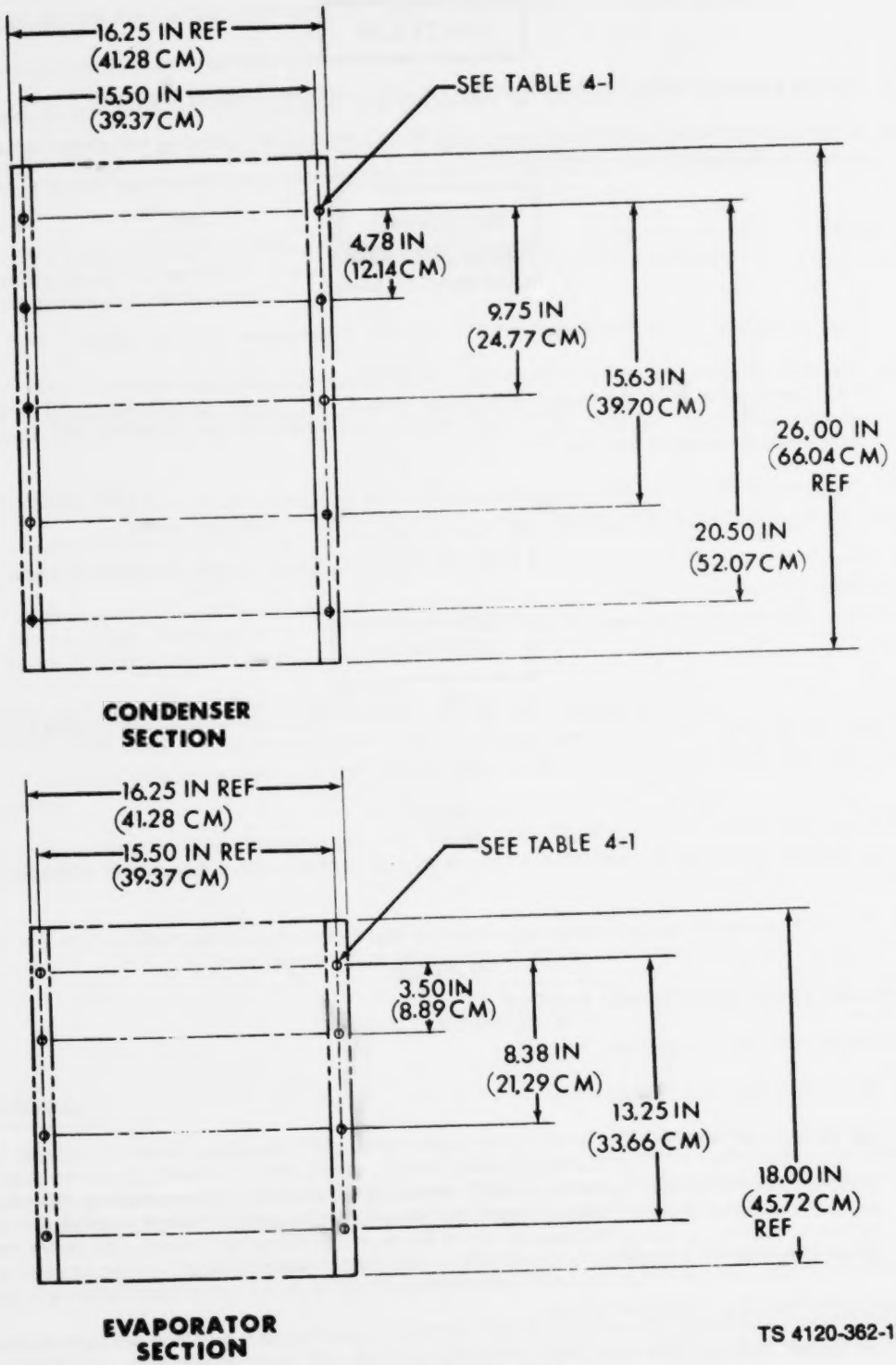

Figure 4-2. Wall Mounting Diagram.

CAUTION

Do not allow the fitting on the unit to turn. Avoid kinking or twisting the hose.

(2) Connect the smaller refrigerant hose to the fittings marked D, following the same instructions and cautions as connection of larger hose.

WARNING

EQUIPMENT DAMAGE

may be caused if unit is operated prior to opening of condenser receiver valve.

(3) The receiver valve is located in the condenser section immediately behind the air intake grille (figure 2-4.). Remove the valve stem cap to expose the stem. Turn this stem counterclockwise as far as it will go and replace and tighten cap. A slight hissing sound may be heard during this process as the refrigerant is released from the tank into the system.

(4) Connect the female end of the electrical cable to the receptacle marked L on the evaporator section. Connect the male end to the receptacle marked L on the condenser section.

(5) Plug in the shorting plug which is chained to the connector on the condenser section above the hood.

CAUTION

Make sure power and power supply plug are compatible with the unit's requirements of a 4-wire system of two 115 volt ac lines, two common 0 volt lines of single phase 50/60 Hertz power.

NOTE

The shorting plug must be used when a time delay unit, for operation of two air conditioners, is not used

(6) Connect the 4-wire power supply cable female end to the receptacle marked P on the condenser section. The other end of the cable is connected to the power supply.

4-5. INITIAL ADJUSTMENTS AND CHECKS

a. Perform the following preliminary checks:

(1) Set Switch SW3 to VENT position.

(2) Set Switch SW2 to ON.

(3) Observe direction of evaporator fan rotation (the only fan that should be operating). Rotation should be counterclockwise when looking down into the evaporator section. See figure 2-4. Double check by noting that air is being discharged out of the four discharge air louvers just above the control panel. If rotation is clockwise, shut off power and check motor wiring.

b. Check operation of controls as follows:

(1) Set Switch SW2 to ON.

(2) Place Switch SW3 in the VENT position. Only the evaporator fan should be on.

(3) Turn Switch SW4 counterclockwise as far as it will go.

(4) Place Switch SW3 in COOL position. The evaporator fan should still be operating alone.

c. Turn Switch SW4 clockwise. The condenser fan and compressor should start. Check the condenser fan rotation. It should be counterclockwise when seen through the rear of the condenser section. See figure 2-5.

Observe the sight glass. It should be clear and free of bubbles after 15 minutes of operation. If operation is as indicated, unit is ready for service. If any malfunction is noted, consult the troubleshooting section of the manual before performing steps again.

Section III.

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

4-6. INTRODUCTION

a. The necessary preventive maintenance checks and services to be performed at the organizational level on a quarterly schedule are listed and described in Table 4-2.

b. They are arranged in a logical sequence as indicated by the item numbers. These numbers shall be used as a source of item numbers for the TM Number Column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.

c. The Item to be Inspected column lists the part or group of parts to be checked and serviced. These parts are identified in figures 4-3 and 4-4.

d. The Procedures column contains a brief description of the procedure by which the check is to be performed.

e. Electrical power should be disconnected from the air conditioner for all checks except the final operations check of the controls.

Section IV

TROUBLESHOOTING

4-7. GENERAL

a. This Section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the air conditioner. Each malfunction for an individual component, unit or system is followed by a list of tests or inspections which will help you to determine corrective actions to take. You should perform the tests/inspections and corrective actions in the oder listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed, or is not corrected by listed corrective actions, notify your supervisor.

c. Table 4-3 lists the common malfunctions which you may find during the operation or maintenance of the air conditioner or its components. You should perform the tests/inspections and corrective actions in the order listed.

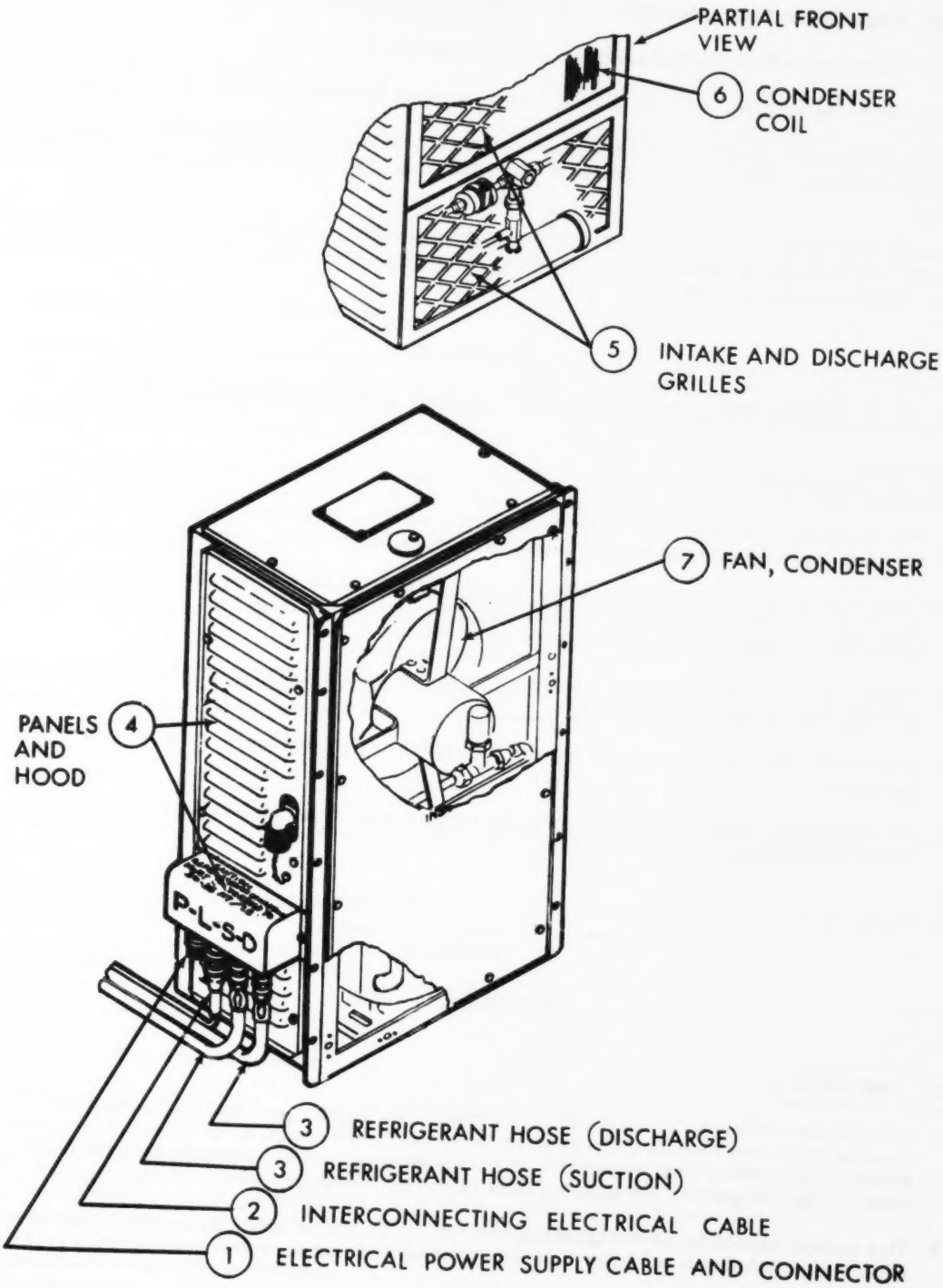

Figure 4-3. Location of PMCS Items Condenser Section.

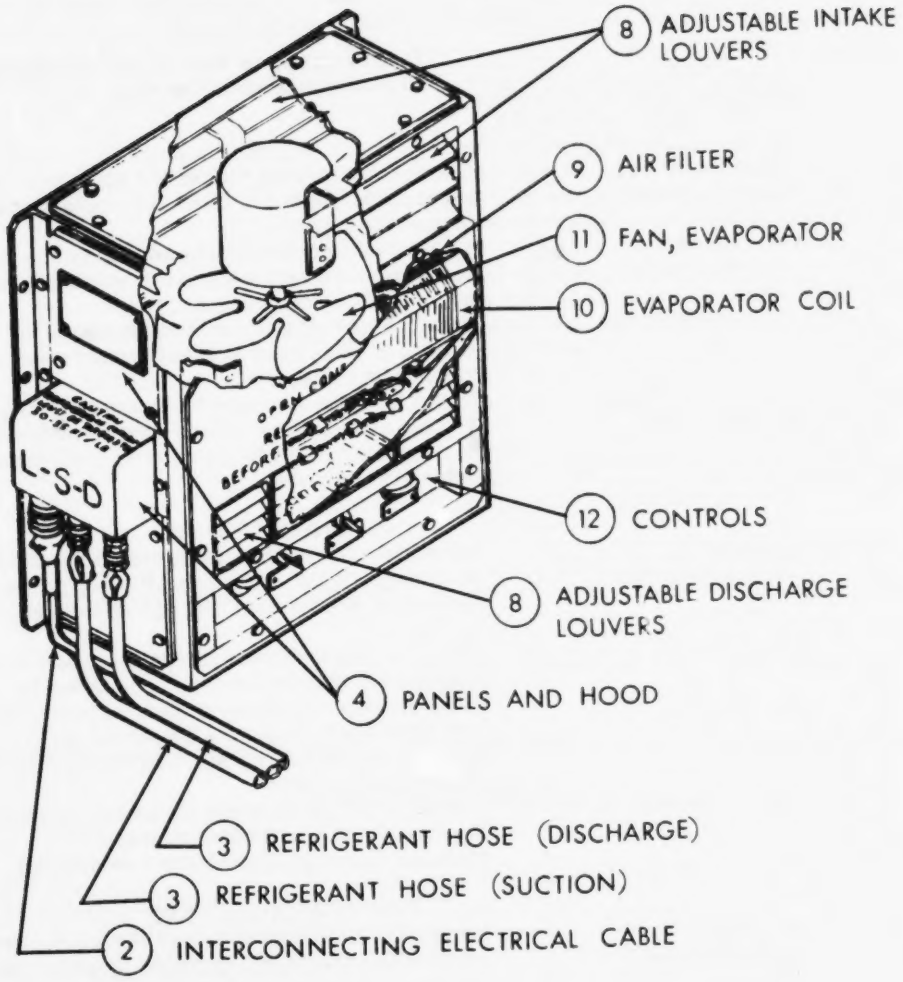

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Figure 4-4. Location of PMCS Items
Evaporator Section

TABLE 4-2 — PREVENTIVE MAINTENANCE CHECKS AND SERVICES
QUARTERLY SCHEDULE

Item No.	Item to be Inspected	Procedures
		WARNING Disconnect power from the air conditioner. The voltage used can be lethal.
1	Electrical power supply cable and connector	Check cable for cuts, cracks and abrasions. Replace cable if defect is found that would expose copper conductor.
2	Interconnecting electrical cable	Check cable for cuts, cracks and abrasions. Replace cable if defect is found that would expose copper conductor.
3	Refrigerant hoses	Inspect hoses for signs of leakage, abrasion, kinking or wear. Refer to direct support maintenance for replacement.
4	Panels and hoods (both sections)	Check for loose mounting hardware or damage. Tighten and repair or replace panels and hoods as necessary. Replace any missing or damaged mounting hardware.
		CONDENSER SECTION
5	Intake and discharge grilles	Inspect for obstructions, loose mounting hardware or damage. Repair or replace damaged grilles. Remove all obstructions and tighten mounting hardware.
6	Condenser Coil	Check for obstructions, damage, leaks and dirt. If damage or leaks are found, report defect to direct support maintenance. Remove obstructions and clean coil if necessary. Be careful not to damage fins. See paragraph 4-29 for specific cleaning instructions.
7	Fan, Condenser	Check for dirt, damage and abnormal vibration. See paragraph 4-15 for specific inspection, cleaning, repair and replacement procedures.
		EVAPORATOR SECTION
8	Adjustable Intake and Discharge Louvers	Inspect for obstructions, ease of operation, loose mounting hardware and damaged or broken parts. See paragraph 4-37 for specific inspection, cleaning, repair, lubrication, repair and replacement procedures.
9*	Air filter	Clean and service or replace if perforated, torn or otherwise damaged. See paragraph 4-45 for specific removal, inspection, cleaning, and reinstallation instructions.

TABLE 4-2 — PREVENTIVE MAINTENANCE CHECKS AND SERVICES
QUARTERLY SCHEDULE

Item No.	Item to be Inspected	Procedures
10	Evaporator Coil	NOTE Perform PMCS on evaporator coil before installing filter. Check for obstructions, damage, leaks and dirt. If damage or leaks are found, report defect to direct support maintenance. Remove obstructions and clean coil if necessary. Be careful not to damage fins. See paragraph 4-47 for specific cleaning instructions.
11	Fan, Evaporator	Check for dirt, damage and abnormal vibration. See paragraph 4-38 for specific inspection, cleaning, repair and replacement procedures.
12	Controls	Inspect controls for loose or broken knobs. Tighten or replace as necessary. Connect power to air conditioner. Check controls for proper operation. See paragraph 2-1. Should malfunction be noted, see Table 4-3, Troubleshooting Chart, and repair as indicated.

*Service monthly or more often when required by operation under severe conditions.

NOTE

Before you use this Table, be sure you have performed all applicable operating checks.

TABLE 4-3 —- TROUBLESHOOTING

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

1. AIR CONDITIONER DOES NOT START

Step 1. Check to be sure main power cable is connected and that power is on.
Connect power cable and turn power on.

Step 2. Check to see that switch SW2 is in the ON position.
Turn switch SW2 to ON.

Step 3. Verify that pressure switch has not tripped.
Open pressure switch reset cover and press reset button.

WARNING

Disconnect power from the air conditioner before doing maintenance work on the electrical system. The voltage used can be lethal.

Step 4. Make sure that power supplied is compatible with unit's 4-wire, 115 V, single phase, 50/60 Hz requirement.

TABLE 4-3 — TROUBLESHOOTING (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Check each wire of supply line with voltmeter per figure 4-7, Wiring Diagram.

Step 5. Inspect main power receptacle connector for defects.
Replace defective connector.

Step 6. Check for loose electrical connections.
Tighten all loose connections.

Step 7. Check fuse F1. Neon glow indicator lit indicates bad fuse.
Replace bad fuse. See para 4-14.

Step 8. Check rectifier CF1. See para 4-18. With 115 volts ac input, the output should be 103 volts, dc.
Replace bad rectifier CF1.

2. EXCESSIVELY NOISY OPERATION

CAUTION

If knocking or hammering is heard when air conditioner is started up, shut down at once and report the condition to direct support maintenance. The compressor may be pumping liquid refrigerant, which will cause severe damage.

Step 1. Listen for knocking or hammering sounds.
Shut down and report to direct support maintenance.

Step 2. Check for defective compressor. See para 4-22.
Report to direct support maintenance.

Step 3. Check evaporator fan for looseness, vibration or interference. See para 4-38.
Tighten setscrews. Look for bent or broken blades that would cause an out-of-balance condition. Replace defective fan as necessary.

Step 4. Check condenser fan for looseness, vibration or interference. See para 4-15.
Tighten setscrews. Look for bent or broken blades that would cause an out-of-balance condition. Replace defective fan as necessary.

Step 5. Check evaporator fan motor for wear as indicated by noisy operation or excessive shaft end- or side-play.
Replace bearings or motor.

Step 6. Check condenser fan motor for wear as indicated by noisy operation or excessive shaft end- or side-play.
Replace bearings or motor.

3. EVAPORATOR FAN MOTOR DOES NOT START

Step 1. Make sure electrical power is supplied to motor.
Tighten connections or connect cable.

WARNING

Disconnect power from the air conditioner before doing maintenance work on the electrical system. The voltage used can be lethal.

Step 2. Check switch SW2 for defects (para 4-34).
Replace defective switch SW2.

Step 3. Check continuity of circuit between power supply and motor. See figure 4-7, Wiring Diagram.
Tighten loose connections. Repair or replace damaged wires.

TABLE 4-3 — TROUBLESHOOTING (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

Step 4. Check fan for freedom of rotation (para 4-38).
Relieve binding of fan blade.
Step 5. Check fan motor temperature.
Replace defective motor.
Step 6. Check for burned out fan motor (para 4-39).
Replace burned out fan motor.
Step 7. Check for defective power relay (para 4-41).
Replace defective power relay.

4. FAN ROTATION WRONG (Evaporator and Condenser)
Step 1. Check for wrong motor wiring. See Wiring Diagram, figure 4-7.
Make motor wiring corrections.

5. CONDENSER FAN MOTOR DOES NOT START
Step 1. Make sure electrical power is supplied to motor.
Tighten connections or connect cable.

WARNING

Disconnect power from the air conditioner before doing maintenance work on the electrical system. The voltage used can be lethal.

Step 2. Check whether switch SW3 is on COOL.
Place switch SW3 in COOL position.
Step 3. Check whether switch SW4 is set in low enough temperature.
Set switch SW4 on COOL.
Step 4. Check for defective power relay (para 4-41).
Replace defective power relay.
Step 5. Check selector switch SW3 for defects. See paragraph 4-35.
Replace defective switch SW3.
Step 6. Check fan for freedom of rotation. See paragraph 4-15.
Relieve binding.
Step 7. Check fan motor temperature.
Replace defective motor.
Step 8. Check for burned out fan motor. See paragraph 4-16.
Replace burned out fan motor.

6. INSUFFICIENT COOLING
Step 1. Check for closed receiver valve.
Open receiver valve.
Step 2. Check evaporator air intake and outlet louvers to make sure they are open, not obstructed, and able to provide adequate air output.
Open louvers or remove obstruction.
Step 3. Test evaporator fan motor for defects. See paragraph 4-39.
Replace evaporator motor.
Step 4. Test compressor for defects. See paragraph 4-22.
Report to direct support maintenance.
Step 5. Check thermostat for defects. See paragraph 4-36.
Replace defective thermostat.

TABLE 4-3 — TROUBLESHOOTING (cont)

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 6. Check sight glass liquid indicator for bubbles. If bubbles exist, check for leaks. See Table 2-1, item 5.
Report to direct support maintenance.
Step 7. Check for clogged filter-drier. Feel filter-drier for temperature difference. Discharge end will either feel cooler than input end if clogged, or may be sweaty or frosty.
Report to direct support maintenance.

7. EVAPORATOR AIR OUTPUT VOLUME INSUFFICIENT
Step 1. Inspect filter for dirt and clogging. See paragraph 4-45.
Clean or replace filter.

WARNING

Disconnect power from the air conditioner before doing maintenance work on the internal parts. The voltage used can be lethal.

Step 2. Evaporator fan loose, binding or damaged.
Tighten setscrews or relieve binding as necessary. Replace damaged fan.
Step 3. Check evaporator fan motor for operation. See paragraph 4-39.
Replace evaporator fan motor.
Step 4. Check evaporator coil for dirt.
Clean evaporator coil. See paragraph 4-47.
Step 5. Check evaporator coil for iced-up condition. If icing is found, it will usually indicate a low cooling load, thermostat is set too low, air flow is blocked or a low refrigerant charge.

CAUTION

Do not use steam, open flame, heat gun or any other high-temperature heat source to thaw an iced coil.

Thaw an iced coil with a lamp bulb (75-watt maximum), hair drier, electric fan or by leaving the unit shut down until ice melts. If condition reoccurs report to direct support maintenance.

8. HEATER FAILS TO OPERATE WHEN EVAPORATOR FAN OPERATES
Step 1. Check if switch SW3 is in HEAT position.
Place switch SW3 in HEAT position.
Step 2. Check if switch SW4 is not set at high enough temperature.
Turn switch SW4 counterclockwise.
Step 3. Inspect power relay K4 for breaks, cracks, corrosion, rust and loose electrical connections. Also check continuity of pins 6 and 7 after relay is removed from socket.
Replace defective relay.
Step 4. Check if heating coil elements are burned out.
Replace heating coil element (para 4-46).

TABLE 4-3 — TROUBLESHOOTING (cont)

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

9. COMPRESSOR FAILS TO OPERATE
   Step 1. Make sure switch SW3 is set on COOL.
   Place switch SW3 in COOL position.
   Step 2. Check if switch SW4 is not set at low enough temperature.
   Turn switch SW4 clockwise.
   Step 3. Check for loose connections in wiring.
   Tighten loose connections.
   Step 4. Inspect power relay K4 for breaks, cracks, corrosion, rust and loose electrical connections. Also check continuity of pins 6 and 7 after relay is removed from socket.
   Replace defective relay.
   Step 5. Check for defective selector switch SW3.
   Replace defective selector switch SW3 (para 4-35).
   Step 6. Check for defective compressor (para 4-22).
   Report to direct support maintenance.

10. COOLING EXCESSIVELY IN COOLING MODE
   Step 1. Check for defective thermostatic expansion valve.
   Report to direct support maintenance.
   Step 2. Inspect power relay K4 for breaks, cracks, corrosion, rust and loose electrical connections. Also check continuity of pins 6 and 7.
   Replace defective power relay K4.
   Step 3. Check thermostat control S4 for defects.
   Replace defective thermostat control S4.

11. LOUVERS FAIL TO OPERATE
   Step 1. Check linkage for possible binding.
   Straighten linkage.
   Step 2. Check for defective control.
   Replace control (para 4-37).
   Step 3. Check for defective louver.
   Replace louver.
   Step 4. Check for foreign object in louver blades.
   Remove foreign object from louver blades.

Section V

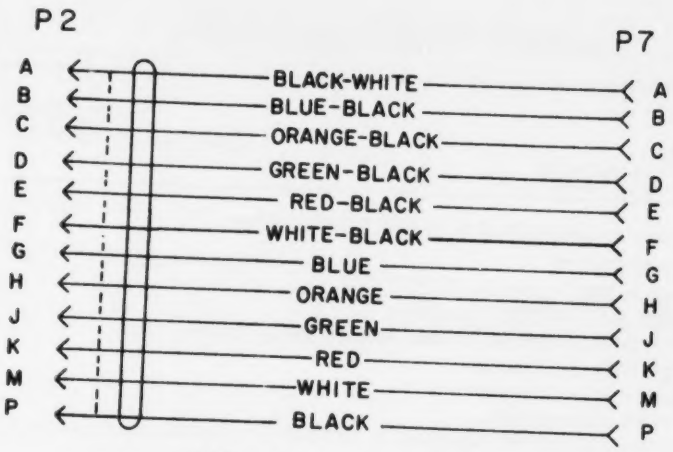
MAINTENANCE PROCEDURES

4-8. INTERCONNECTING CABLE ASSEMBLY (figure 4-5).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Removal. Unscrew both connectors and remove the interconnecting cable assembly.



SCHEMATIC DIAGRAM

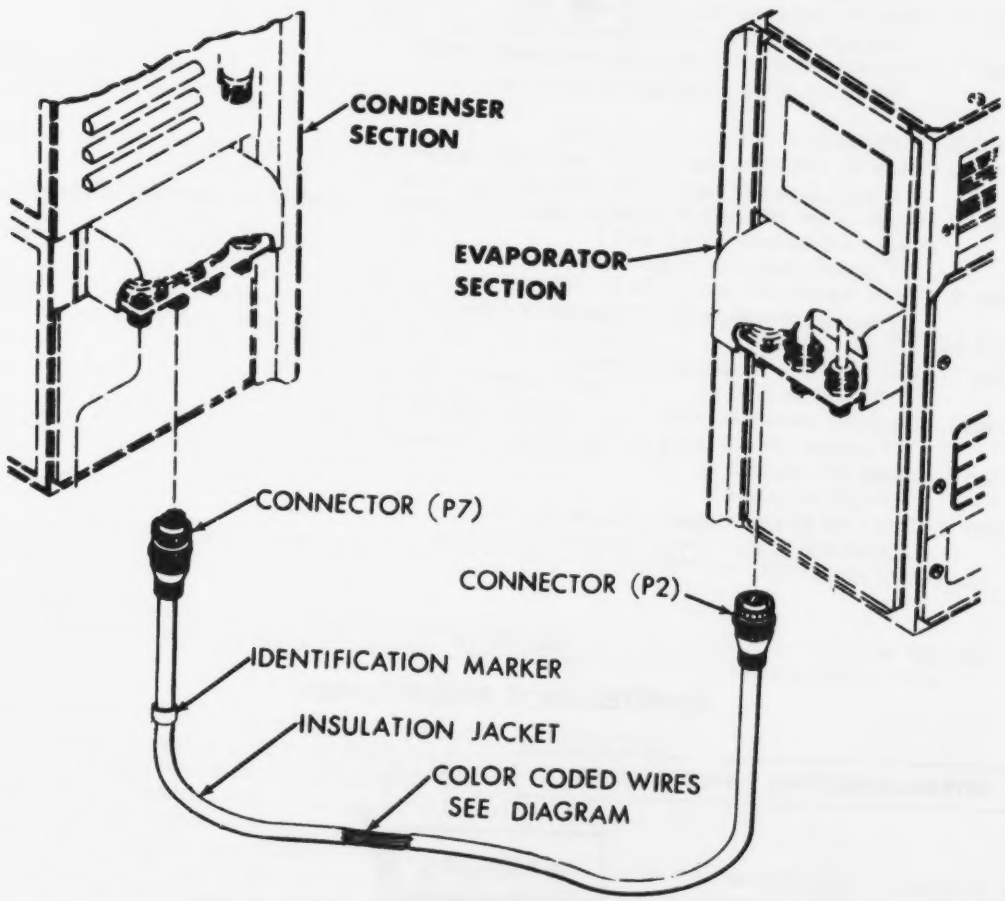


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Figure 4-5. Interconnecting Cable.

b. Inspection.

(1) Inspect connectors for damage and loose or broken pins. Replace if defective.

(2) Inspect plastic insulation jacket for cracks, cuts, abrasions and loose ends. Replace, if damage is such that it would allow moisture to enter cable assembly.

(3) Check individual wires for loose solder connections or damaged wires. Repair solder connections and replace damaged wires.

c. Testing. Using wiring diagram in figure 4-5, check individual wires for continuity. If continuity is not indicated, check solder connections and replace all damaged wires.

d. Repair. When repairing solder joints, wire connections must be made mechanically sound before they are soldered; solder alone does not provide sufficient strength to prevent breakage. Surfaces of connections to be soldered must be clean and bright. If a separate flux is used, it should conform to Specification MIL-F-4995, Type I, resin-alcohol flux, and should be brushed onto the joint before soldering. If a flux-core solder is used, it should always be resin-core electrical solder. If an uncored solder is used, it should be a lead-tin solder conforming to Specification QQ-S-571. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive buildup of solder globs on the joint should be avoided or removed.

e. Installation. Screw connector P2 to the connection point marked L on the evaporator section. Screw connector P7 to the connection point marked L on the condenser section. Make sure they are tight.

4-9. REFRIGERANT HOSES (figure 4-6).

a. Inspection/test-installed. Check hose ends and fittings for cracks, breaks and other obvious defects. Check hose for abrasions, cuts and cracks. Inspect hose assemblies and fittings for any indication of refrigerant leakage. If leakage is indicated, test by one of the following methods:

CAUTION

The electronic leak detector is sensitive to the presence of refrigerant gas in the atmosphere. When refrigerant gas is present in the atmosphere of work area, false indications can result. Use in a well ventilated but draft-free area.

(1) Electronic Leak Detector. Turn the electronic unit on, and slowly pass the probe around all points of the refrigeration system at which a leak could exist. Depending upon the type of detector used, a leak will be indicated by an audible signal, a light, or by meter deflections.

(2) Soap Solution. Brush soap solution on all possible points of leakage, and watch for bubbles. Follow a definite sequence to avoid missing any points that should be tested. Wipe the solution from all joints, and mark any point at which a leak is found.

b. Replacement. If inspection/test results show any of the above defects, report to direct support maintenance for hose removal and replacement.

4-10. ELECTRICAL CONNECTOR (POWER SUPPLY)

This connector is supplied as original equipment with the air conditioner. The connecting cable and end connection to power source may vary since this is installed by the user. See wiring diagram, figure 4-7 and locator illustration, figure 4-3 for location.

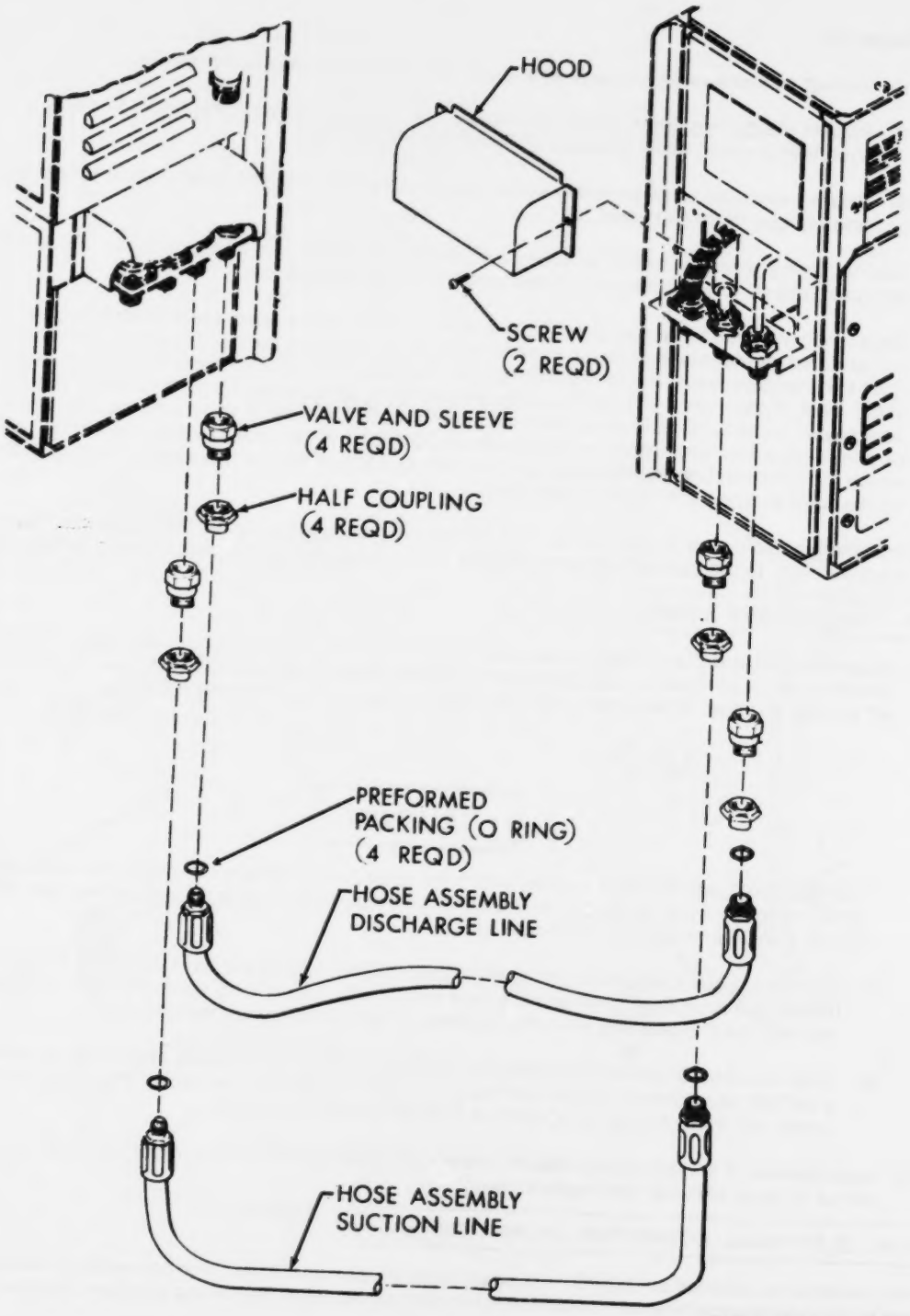
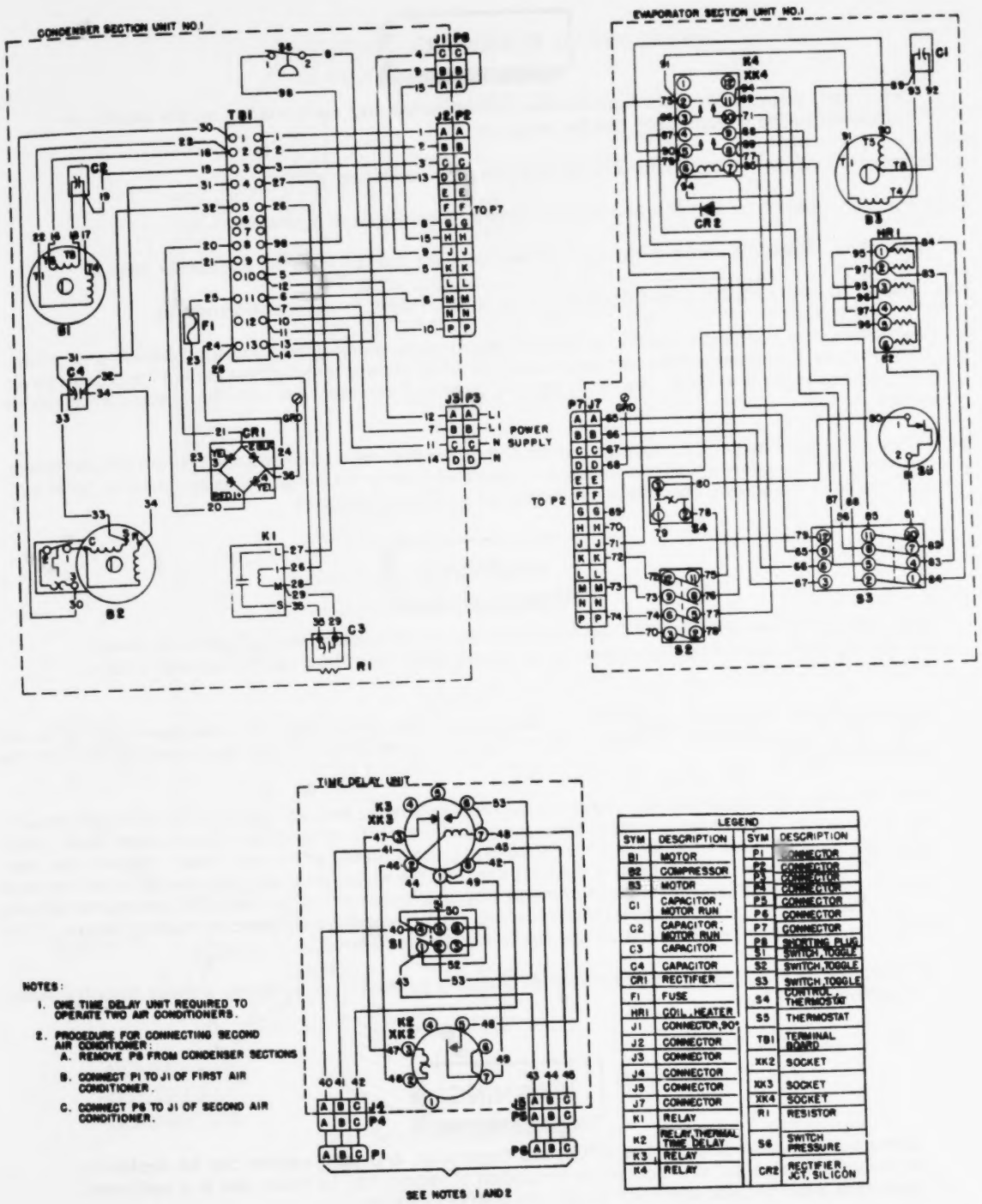


Figure 4-6. Interconnecting Hoses.



NOTES:

1. ONE TIME DELAY UNIT REQUIRED TO OPERATE TWO AIR CONDITIONERS.
2. PROCEDURE FOR CONNECTING SECOND AIR CONDITIONER:
   A. REMOVE P8 FROM CONDENSER SECTION.
   B. CONNECT P1 TO J1 OF FIRST AIR CONDITIONER.
   C. CONNECT P8 TO J1 OF SECOND AIR CONDITIONER.

LEGEND

SYM	DESCRIPTION	SYM	DESCRIPTION
B1	MOTOR	P1	CONNECTOR
B2	COMPRESSOR	P2	CONNECTOR
B3	MOTOR	P3	CONNECTOR
C1	CAPACITOR, MOTOR RUN	P4	CONNECTOR
C2	CAPACITOR, MOTOR RUN	P5	CONNECTOR
C3	CAPACITOR	P6	CONNECTOR
C4	CAPACITOR	P7	CONNECTOR
CR1	RECTIFIER	P8	SHORTING PLUG
F1	FUSE	S1	SWITCH, TOGGLE
HR1	COIL, HEATER	S2	SWITCH, TOGGLE
J1	CONNECTOR, 90°	S3	SWITCH, TOGGLE
J2	CONNECTOR	S4	CONTROL, THERMOSTAT
J3	CONNECTOR	S5	THERMOSTAT
J4	CONNECTOR	TB1	TERMINAL BOARD
J5	CONNECTOR	XK2	SOCKET
J7	CONNECTOR	XK3	SOCKET
K1	RELAY	XK4	SOCKET
K2	RELAY, THERMAL TIME DELAY	R1	RESISTOR
K3	RELAY	S6	SWITCH, PRESSURE
K4	RELAY	CR2	RECTIFIER, JCT, SILICON

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Figure 4-7. Wiring Diagram.

WARNING

Disconnect power from the air conditioner before performing maintenance on the electrical components. The voltage used can be lethal.

a. Removal. Unscrew the connector and remove from the condenser section.

b. Inspection. Inspect for damage and loose or broken pins. Replace if defective.

c. Installation. Screw the connector to the connection point marked P on the condenser section.

4-11. PANELS, GRILLES AND HOOD (CONDENSER SECTION)

(figures 4-8 and 4-9).

a. Description. The condenser section is housed within metal panels, fixed louvered panels and grilles. Quick release 1/4 turn stud fasteners permit easy removal of panels and grilles except the discharge air grille, access cover and hood. The discharge air grille and the hood are retained by standard machine screws.

b. Removal. Remove the panels, louvered panels and grilles that have quick release 1/4 turn stud fasteners by turning the fasteners 1/4 turn counterclockwise and pulling the panel, louvered panel or grille outward. Remove the screws that retain the discharge grille and the hood.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

c. Cleaning. Clean the panels, louvers and grilles with a cloth dampened with a detergent solution or dry cleaning solvent (Fed Spec P-D-680). Use a soft brush if necessary to dislodge caked on dirt. Dry the items thoroughly.

d. Inspection/Repair. Inspect panels, louvers and grilles for breaks, cracks, dents, loose or missing mounting hardware or other defects. Repair breaks, cracks, and dents using conventional sheet metal repair methods. Replace missing mounting hardware and panels damaged beyond repair. Inspect the identification plate riveted to the outside of the top panel and the wiring diagram plate riveted to the inside of the rear panel for legibility and obvious damage. Replace if you cannot read all of the information shown on the plate. Inspect gasket material for hardening, permanent set, cuts, tears or missing pieces. If it is necessary to replace gasket material, use the following procedure:

(1) Remove as much old gasket material as possible by pulling or scraping it away from the metal surface.

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable, and their vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use in a well-ventilated area, wear gloves, and keep away from sparks or flame.

(2) Soften and remove old adhesive and gasket residue, using acetone or methyl-ethyl ketone (MEK) and a stiff brush.

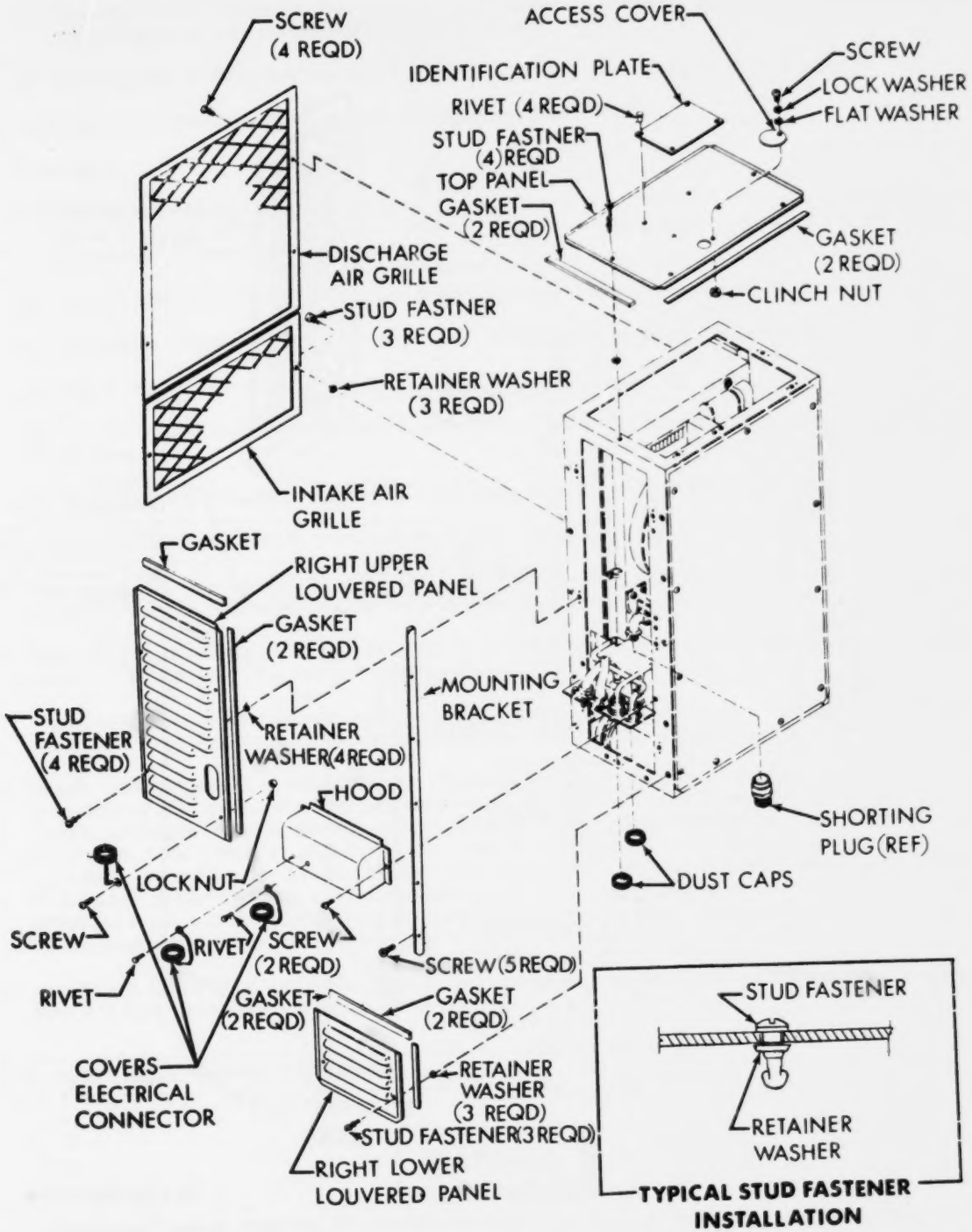

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Figure 4-8. Panels, Grilles and Hood (Front, Top and Left Side)

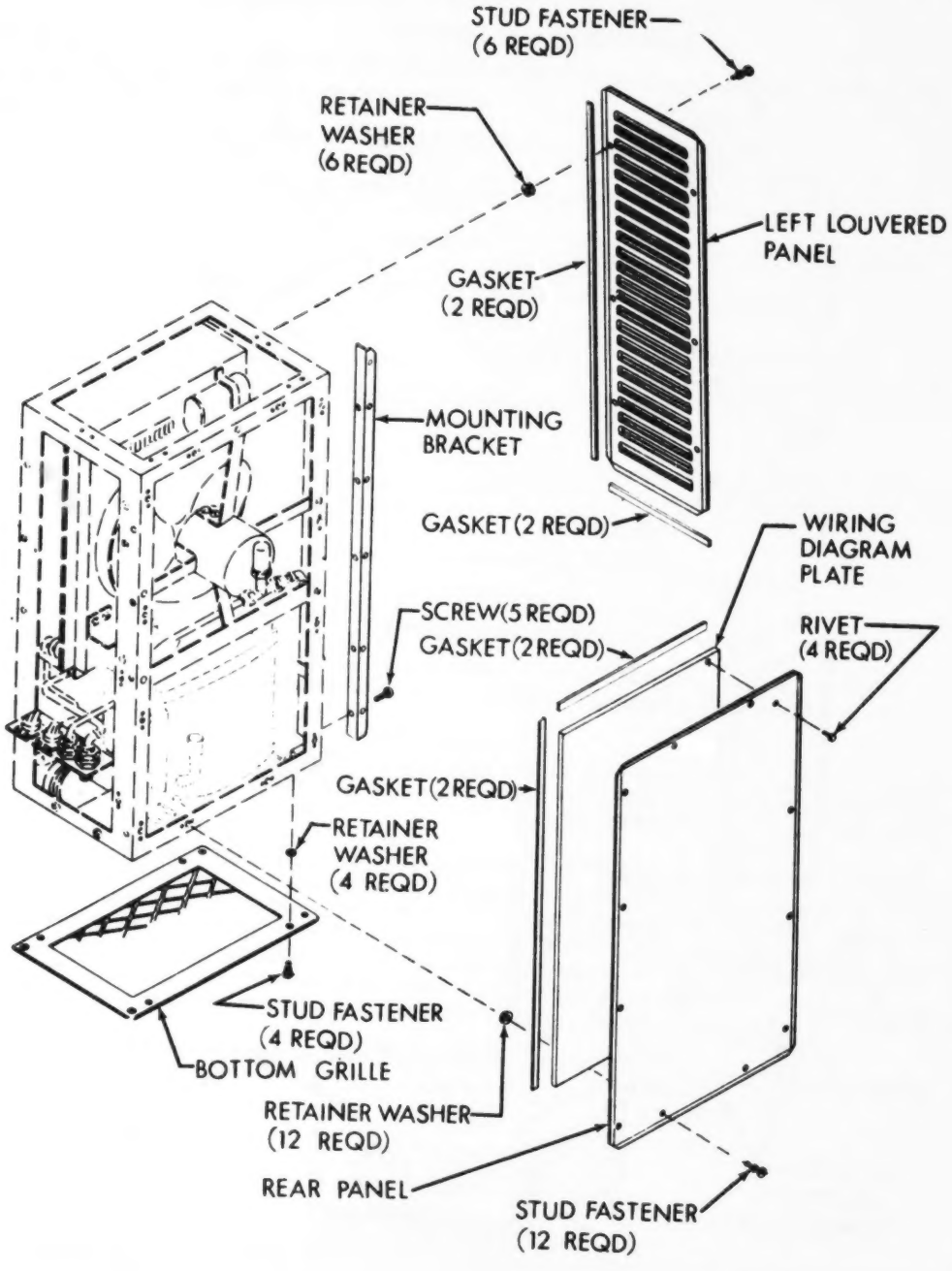

Figure 4-9. Panels and Grilles
(Rear, Bottom and Right Side)

(3) Coat the mating surfaces of the metal and the gasket with adhesive. Let both surfaces air dry until the adhesive is tacky but will not stick to the fingers.

(4) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

e. Painting. Should touch up or refinishing be necessary, see TM43-0139.

f. Installation.

(1) Access cover. Install on top panel using a screw, lock washer and flat washer. A retained nut is provided in the top panel to retain this hardware. Tighten so that access cover can be moved without loosening the screw with a screw driver.

(2) Identification plate and wiring diagram plate. If these plates were removed, reinstall with rivets.

(3) If electrical connector covers were removed, reinstall with screw and nut or rivets.

(4) Attach the hood and discharge air grille with screws.

(5) See the typical stud fastener installation detail on figure 4-8 for installation of any missing stud fasteners.

(6) Position the remaining panels and grilles and engage the 1/4 turn stud fasteners.

4-12. CONNECTOR ELECTRICAL (SHORTING PLUG) (figure 4-7).

a. Description. The shorting plug is used for single unit installations. See the wiring diagram (figure 4-7) for further information. The shorting plug is P8 on the wiring diagram.

b. Removal. The shorting plug is located on the right side of the condenser section (figure 4-8). Unscrew connector protective cover. Remove shorting plug.

c. Test. Check for continuity between pins A and C. If continuity is not indicated, check solder connections and condition of wire. Repair bad solder connections and replace jumper wire if it is damaged.

d. Repair. During repair of solder joints, wire connections must be made mechanically sound before they are soldered; solder alone does not provide sufficient strength to prevent breakage. Surfaces of connections to be soldered must be clean and bright. If a separate flux is used, it should conform to Specification MIL-F-4995, Type I, resin-alcohol flux, and should be brushed onto the joint before soldering. If a flux-core solder is used, it should always be resin-core electrical solder. If an uncored solder is used, it should be a lead-tin solder conforming to Specification QQ-S-571. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive buildup of solder globs on the joint should be avoided or removed.

e. Installation. Screw shorting plug to elbow connector on the right side of the condenser section. Make sure it is tight. Screw the connector protective cover back in place.

4-13. ELECTRICAL WIRING (CONDENSER SECTION) (Figure 4-10).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Access. Remove the following outside panels.

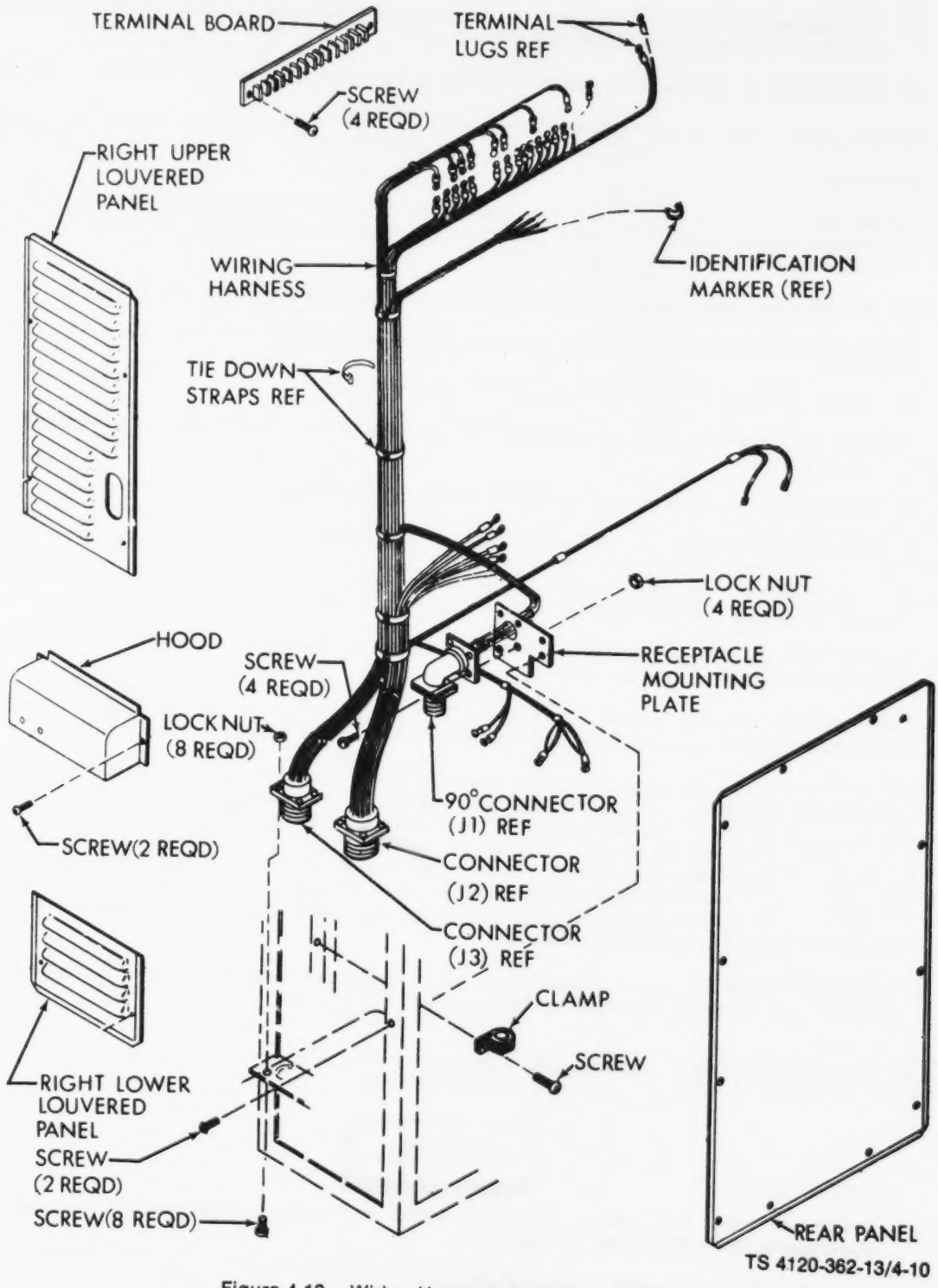

Figure 4-10. Wiring Harness, Condenser Section.

(1) Remove the right upper louvered panel, the right lower louvered panel and the rear panel by turning the quick release 1/4 turn stud fasteners counterclockwise.

(2) Remove the hood by unscrewing the machine screws.

b. Inspection.

(1) Inspect connectors for damage and loose or broken pins. Replace if defective.

(2) Check individual wires for loose solder connections, loose terminal lugs, cut or frayed insulation, cut or broken wires. Repair or replace if defective.

(3) Check terminal board for cracks and breaks. Replace if defective.

c. Testing. Using wiring diagram in figure 4-5, check individual wires for continuity. If continuity is not indicated, check solder and terminal lug connections and condition of wire. Repair all bad solder connections and replace all damaged wires.

d. Repair or Replace. Preferred repair methods consist of replacing wires, terminals, connectors, etc., rather than splicing wires, bending ends to form terminals, and other makeshift procedures, although the latter may be appropriate for emergency field repairs. Determine the proper size and length of wire, terminal or connector to be used for replacement by referring to Table 4-4, Wire List, and to the wiring diagram (figure 4-7).

(1) Soldering Connections. Wire connections must be made mechanically sound before they are soldered; solder alone does not provide sufficient strength to prevent breakage. Joining surfaces of connections to be soldered must be clean and bright. If a separate flux is used, it should conform to Specification MIL-F-4995, Type I, resin-alcohol flux, and should be brushed onto the joint before soldering. If a flux-core solder is used, it should always be resin-core electrical solder. If an uncored solder is used, it should be a lead-tin solder conforming to Specification QQ-S-571. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive buildup of solder globs on the joint should be avoided or removed.

TABLE 4-4 WIRE LIST CONDENSER SECTION

Ident. No. (Marketing)	TERMINATION		TERMINATION		Awg Wire Size	LENGTH	
	From	Terminal Type	To	Terminal Type		IN.	CM.
		WIRING HARNESS CONDENSER SECTION					
1	TB1-1	MS25036-106	J2-A	MS3102R22-19S	16	25	63.5
2	TB1-2	MS25036-106	J2-B	MS3102R22-19S	16	25	63.5
3	TB1-3	MS25036-106	J2-C	MS3102R22-19S	16	25	63.5
4	TB1-9	MS25036-106	J1-C	13211E4742 (97403)	16	21	53.3
5	TB1-10	MS25036-106	J2-K	MS3102R22-19S	16	28	71.1
6	TB1-11	MS25036-106	J2-M	MS3102R22-19S	16	28	71.1
7	TB1-11	MS25036-106	J3-B	MS3102R18-4P	16	28	71.1
8	S6-2	41532 (00779)	J2-G	MS3102R22-19S	16	33	83.8
9	J1-B	13211E4742 (97403)	J2-J	MS3102R22-19S	16	16	40.6
10	TB1-12	MS25036-106	J2-P	MS3102R22-19S	16	29	73.7
11	TB1-12	MS25036-106	J3-C	MS3102R18-4P	16	29	73.7
12	TB1-10	MS25036-106	J3-A	MS3102R18-4P	16	28	71.1
13	TB1-13	MS25036-106	J2-D	MS3102R22-19S	16	29	73.7
14	TB1-13	MS25036-106	J3-D	MS3102R18-4P	16	29	73.7
15	J2-H	MS3102R22-19S	J1-A	13211E4742 (97403)	16	16	40.6
19	C2	41532 (00779)	TB1-3	MS25036-106	16	9	22.9
20	CR1-1	—	TB1-8	MS25036-106	16	15	38.1
21	CR1-2	—	TB1-9	MS25036-106	16	14	35.6
24	CR1-4	—	TB1-13	MS25036-106	16	16	40.6
25	F1	—	TB1-11	MS25036-106	16	16	40.6

TABLE 4-4 WIRE LIST CONDENSER SECTION

Ident. No. (Marking)	TERMINATION		TERMINATION		Awg Wire Size	LENGTH	
	From	Terminal Type	To	Terminal Type		IN.	CM.
		WIRING HARNESS CONDENSER SECTION (Continued)					
26	K1-I	41532 (00779)	TB1-5	MS25036-106	16	22	55.9
27	K1-L	41532 (00779)	TB1-4	MS25036-106	16	22	55.9
28	K1-M	41532 (00779)	TB1-13	MS25036-106	16	28	71.1
29	K1-M	MS25036-106	C3	41532 (00779)	16	18	45.7
30	B2-3		TB1-1	MS25036-106	16	29	73.6
31	B2-R	41532 (00779)	TB1-5	MS25036-106	16	31	78.7
32	B2-S	41532 (00779)	TB1-4	NS25036-106	16	31	78.7
33	C4	41532 (00779)	B2-S	41532 (00779)	16	23	58.4
34	C4	41532 (00779)	B2-R		16	23	58.4
35	K1-S	41532 (00779)	C3	41532 (00779)	16	18	45.7
98	S6-1	41532 (00779)	TB1-8	MS25036-106	16	13	33.0
		LOOSE WIRE CONDENSER SECTION					
36	CR1-4	—	GRD	MS25036-153	16	10	25.4

(2) Insulating Joints. The preferred method of insulating electrical joints is by the use of heat-shrink tubing. To apply, cut a piece of heat-shrink tubing of suitable diameter to a one-inch (2.54 cm) length for covering joints at terminals or connectors, or to a length about 1/2-inch (1.27 cm) longer than the joint to be insulated, and slide the tubing over the wire before making the joint. After the joint is made, slide the tubing over the joint, and shrink in place with moderate heat.

(3) Splicing Wires. To repair broken or cut wires that are otherwise sound, the mating ends can be stripped and spliced. A commercial butt splice can be crimped onto the ends to join them, or a Western Union wire splice can be made. The latter is made by stripping 1-1/4 inch (3.18 cm) of insulation from the wire ends, holding the ends parallel and facing opposite directions, then twisting each end around the other wire at least three turns. Solder and apply insulation as described above.

(4) Crimping Terminals. To install a terminal on the end of a wire, strip 1/4 to 1/2 inch (0.66 to 1.27 cm) of insulation from the end of the wire, apply a one-inch (2.54 cm) piece of heat-shrink tubing (if the terminal is of the uninsulated type), and insert wire-end into the shank of the terminal. Crimp the shank, and install heat-shrink tubing if necessary.

e. Reassembly. Reinstall the following outside panels.

(1) Attach the hood with two machine screws.

(2) Reinstall the right upper louvered panel, the right lower louvered panel and the rear panel by positioning the panel and engaging the 1/4 turn stud fasteners.

4-14. FUSE (CONDENSER SECTION)

a. Inspection of installed items (figure 4-11). The circuit from the power supply connector to the rectifier contains fuse F1.

(1) Remove rear panel from condenser section.

(2) Observe indicator cap on fuse holder. If this fuse is burned out, the cap which contains a neon lamp indicator will light until the defective fuse is replaced.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

b. Removal.

(1) Disconnect power.

(2) Push in on indicator cap, turn counterclockwise and remove cap.

(3) Remove fuse and check for melted or broken element. If the fuse is defective, replace it with a new fuse.

c. Installation.

(1) Place fuse in fuse holder.

(2) Replace indicator cap.

(3) Connect power.

(4) Observe indicator cap. If fuse is good, the lamp in the cap will not light.

(5) Install the rear panel.

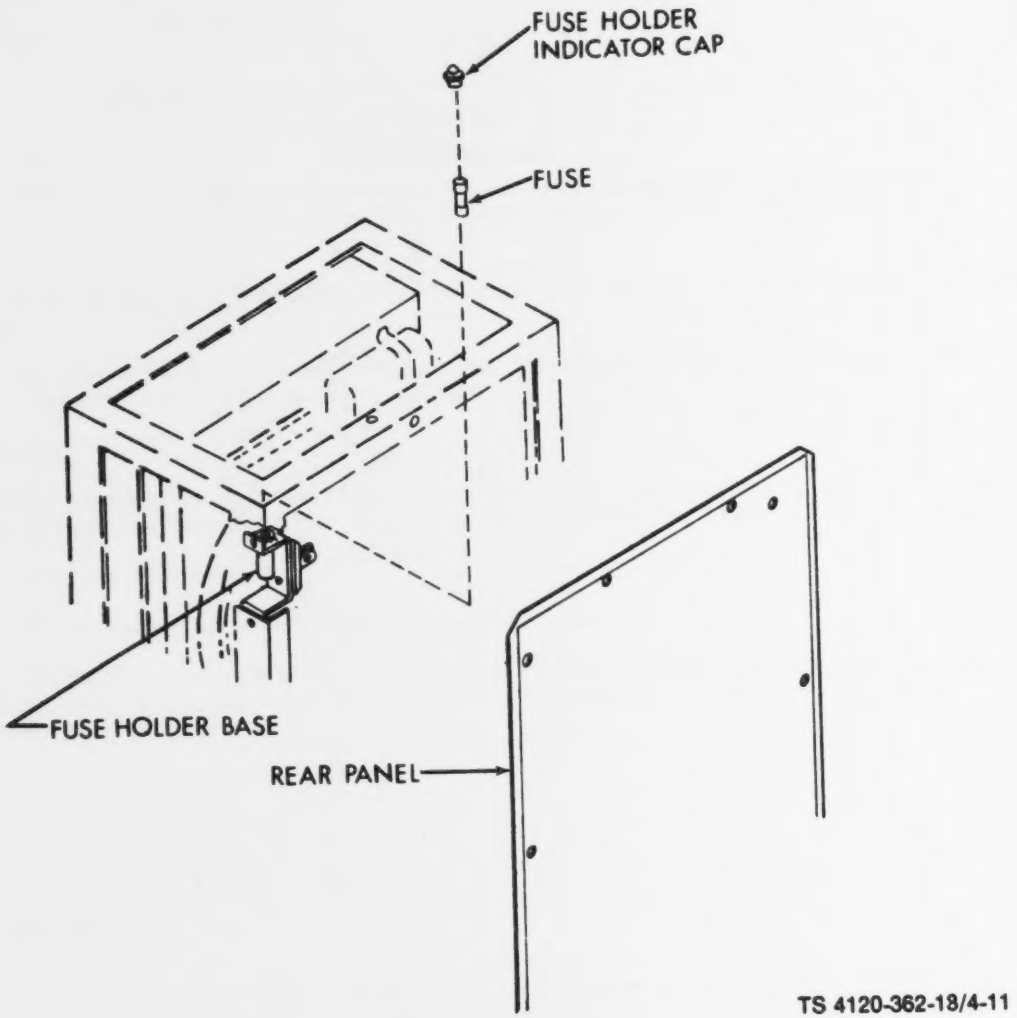

Figure 4-11. Fuse, Condenser Section.

4-15. CONDENSER FAN (figure 4-12).

a. Removal.

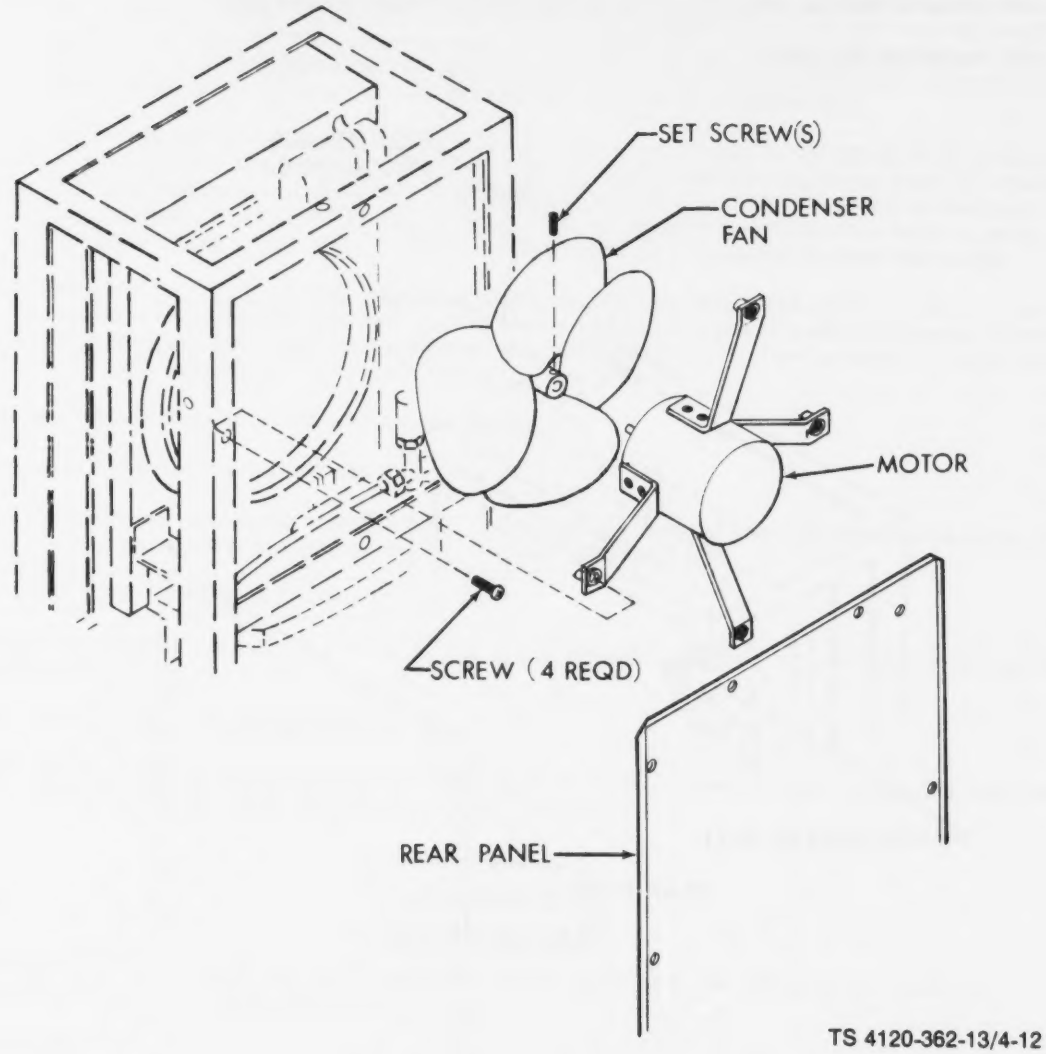

Figure 4-12. Condenser Fan.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the rear panel.

(3) Remove the four screws from the motor mounting brackets.

(4) Carefully move the fan and motor assembly out of the unit to a point where the fan can be removed from the motor shaft. Support the motor assembly so that the wires are not damaged.

(5) Loosen the setscrew(s) and remove the fan.

b. Cleaning.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

Wipe the fan blades with a clean cloth dampened slightly with dry cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

c. Inspection. Check the fan for breaks, cracks, dents, loose rivets and bent or otherwise deformed fan blades. Replace the condenser fan if it is defective.

d. Installation.

(1) Slip the fan onto the motor shaft with hub facing the motor and approximately 1/2 inch (1.27 cm) of shaft extending through the hub. Align the setscrews with the flat surfaces on the motor shaft.

(2) Tighten the setscrew(s).

(3) Carefully position the fan and motor assembly in the unit.

(4) Install the four screws and check fan for clearance by spinning the fan by hand. Clearance between the blade tips and fan shroud should be even. If necessary, loosen the screws and adjust the clearance.

(5) Install the rear panel.

(6) Connect power to the unit.

4-16. CONDENSER FAN MOTOR (figure 4-13).

a. Removal.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the rear panel.

(3) Tag and disconnect the motor leads from the terminal board and the capacitor.

(4) Remove the four screws that attach the motor mounting brackets to the frame.

(5) Carefully remove the motor and fan assembly from the unit.

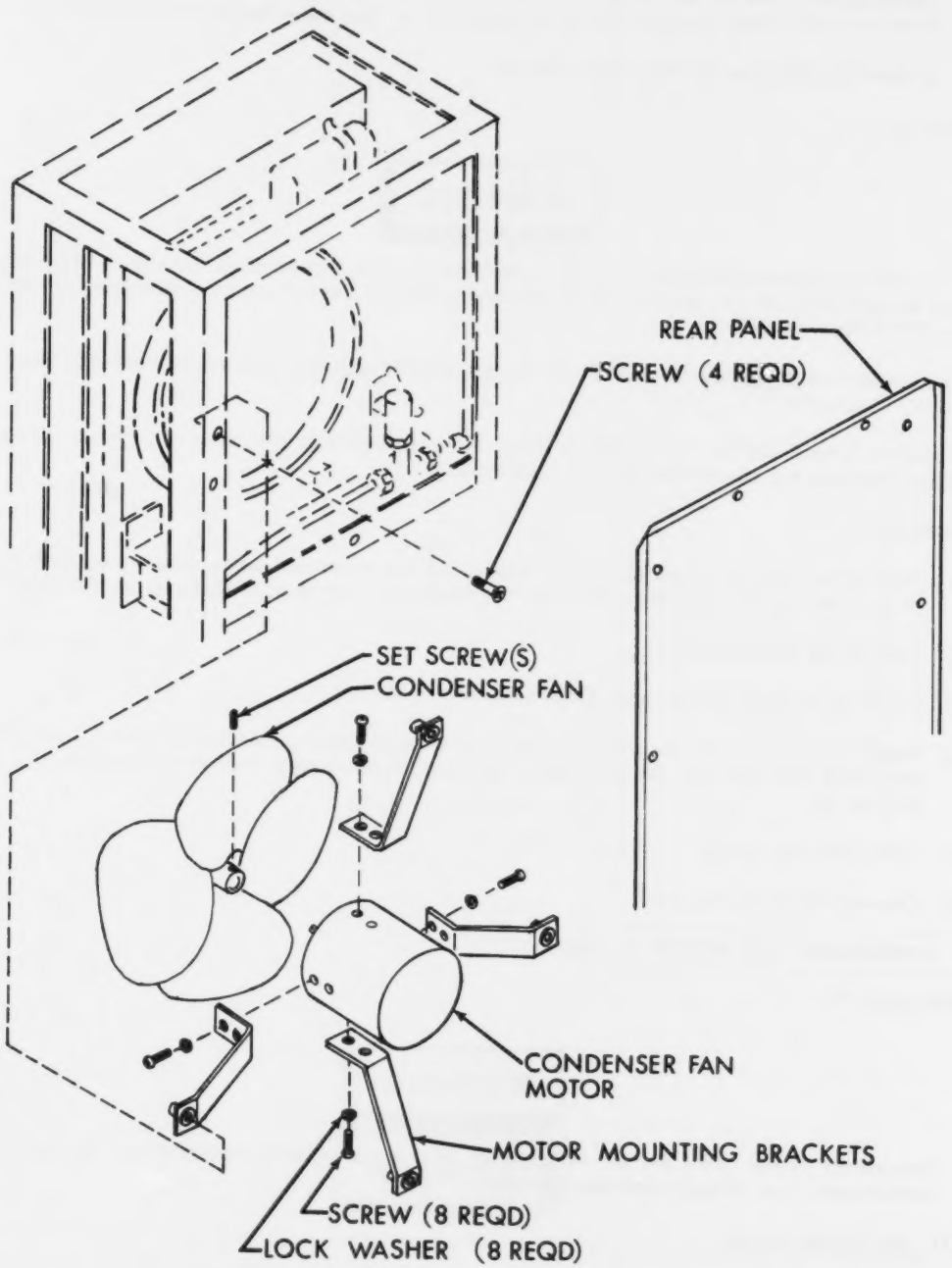

Figure 4-13. Condenser Fan Motor.

(6) Loosen the setscrew(s) and remove the fan.

(7) Remove the eight screws and lock washers that attach the motor mounting brackets and remove the brackets.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

b. Cleaning. Wipe the motor and the other disassembled parts with a clean cloth dampened slightly with dry cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

c. Inspection.

(1) Check the motor for dents, cracks, condition of threads in mounting holes, loose or damaged lead wires and free rotation of motor shaft. If a defect is found that could cause the unit to malfunction, replace the motor.

(2) Check the fan for breaks, cracks, dents, loose rivets and bent or otherwise deformed fan blades. Replace the fan if it is defective.

(3) Check the mounting brackets for breaks, cracks, dents and condition of threads in blind nuts. Repair minor damage using conventional sheet metal repair methods. Replace damaged blind nuts or total bracket if damage indicates replacement.

d. Testing.

(1) Using a continuity tester, check for continuity between motor leads. If a lack of continuity is shown, an open winding is indicated. Replace the motor.

(2) Check for continuity between the red lead and the motor frame. If there is continuity, one of the windings is shorted to ground. Replace the motor.

e. Installation.

(1) Attach the motor mounting brackets to the motor with eight screws and lock washers. Take care not to strip the threads in the aluminum motor housing. The two identical brackets go to the sides, the longest bracket to the top and the shorter bracket to the bottom.

(2) Slip the fan onto the motor shaft with the hub facing the motor and approximately 1/2 inch (1.27 cm) of shaft extending through the hub. Align the setscrew(s) with the flat surfaces on the motor shaft and tighten the setscrew(s).

(3) Carefully position the fan and motor assembly in the unit.

(4) Install the four screws and check fan for clearance by spinning the fan by hand. Clearance between the blade tips and the fan shroud should be even. If necessary, loosen the mounting bracket screws and adjust the clearance.

(5) Connect the motor leads to the terminal board and capacitor. See tags on removed motor and see wiring diagram, figure 4-7.

(6) Install the rear panel.

(7) Connect power to the unit.

4-17. PRESSURE SWITCH (CONDENSER SECTION) (figure 4-14).

This switch is a high pressure cutout that deenergizes the air conditioner when the condensing pressure reaches 325 psig.

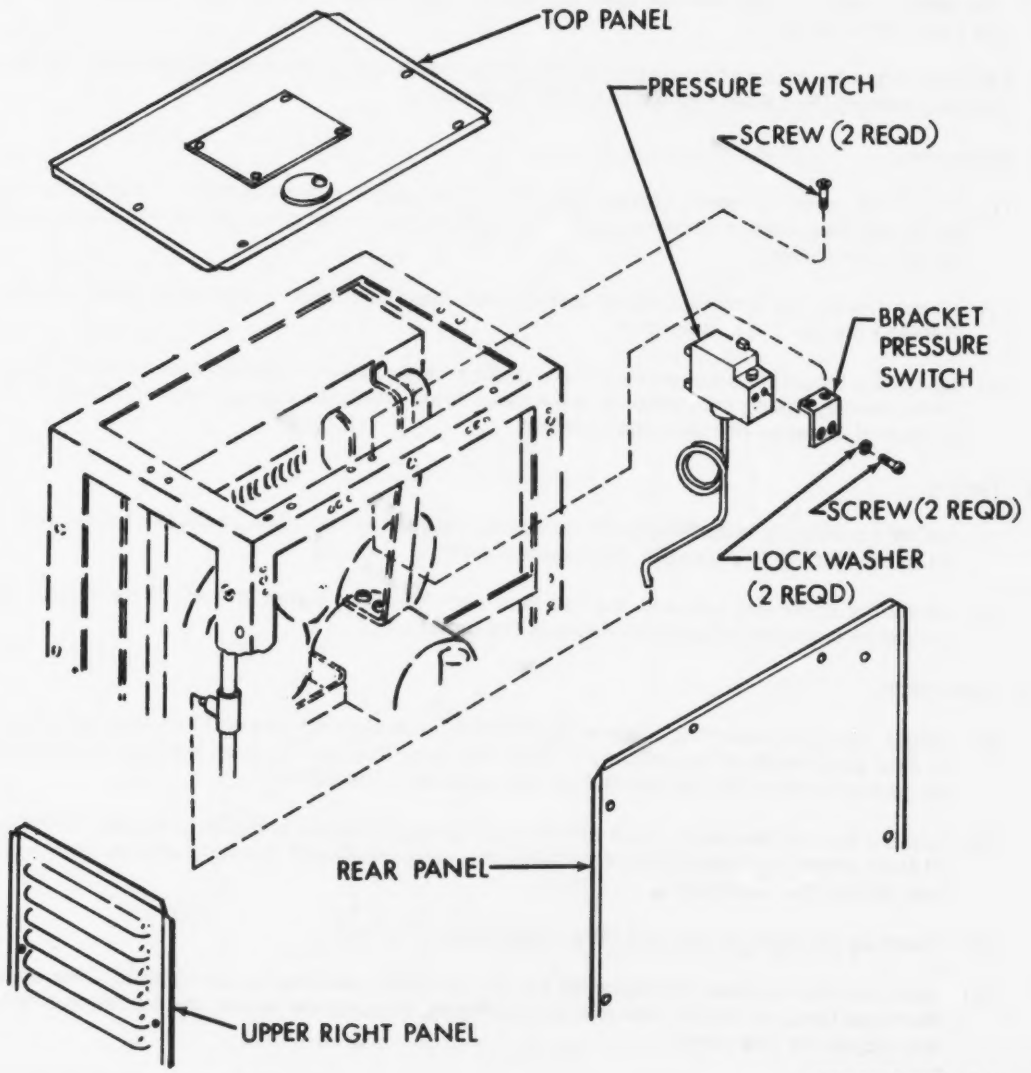

Figure 4-14. Pressure Switch

a. Operational check.

(1) With the air conditioner operating in the cooling mode, install a yoke-type ammeter around the power supply cable. Note the reading.

(2) Press, then release, the pressure cutout reset button while watching the ammeter. The ammeter reading should drop when the reset button is pressed, and return to its original reading then the button is released.

(3) If the ammeter does not respond when the button is pressed and released, the switch is defective. Report the condition to direct support maintenance.

b. Access. Remove the top, upper right and rear panels.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

c. Inspection of installed items.

(1) Disconnect power.

(2) Check for loose terminals, missing mounting hardware, cracks, breaks or other defects or damage. Replace defective parts.

d. Replacement. When it is necessary to replace the pressure switch, report condition to direct support maintenance (paragraph 5-4).

e. Cleaning. Wipe the pressure switch with a clean, dry, lint free cloth.

f. If operational check and inspection indicated that parts were acceptable, replace the top, upper right and rear panels and connect power.

4-18. RECTIFIER (CONDENSER SECTION) (figure 4-15).

Rectifier CR1 is required to transform alternating current into direct current for the control circuit. It is mounted on the fuse bracket in the condenser section.

a. Access. Remove the upper right panel and the rear panel.

WARNING

The following test must be conducted with the power on. Exercise extreme caution.

b. Operational check.

(1) Place power switch SW2 in ON position.

(2) With a voltmeter, check for input voltage of 115 volts ac. With the proper input voltage, check for output of 103 volts dc. Refer to figure 4-7, wiring diagram. Replace the rectifier if it is defective.

c. Removal.

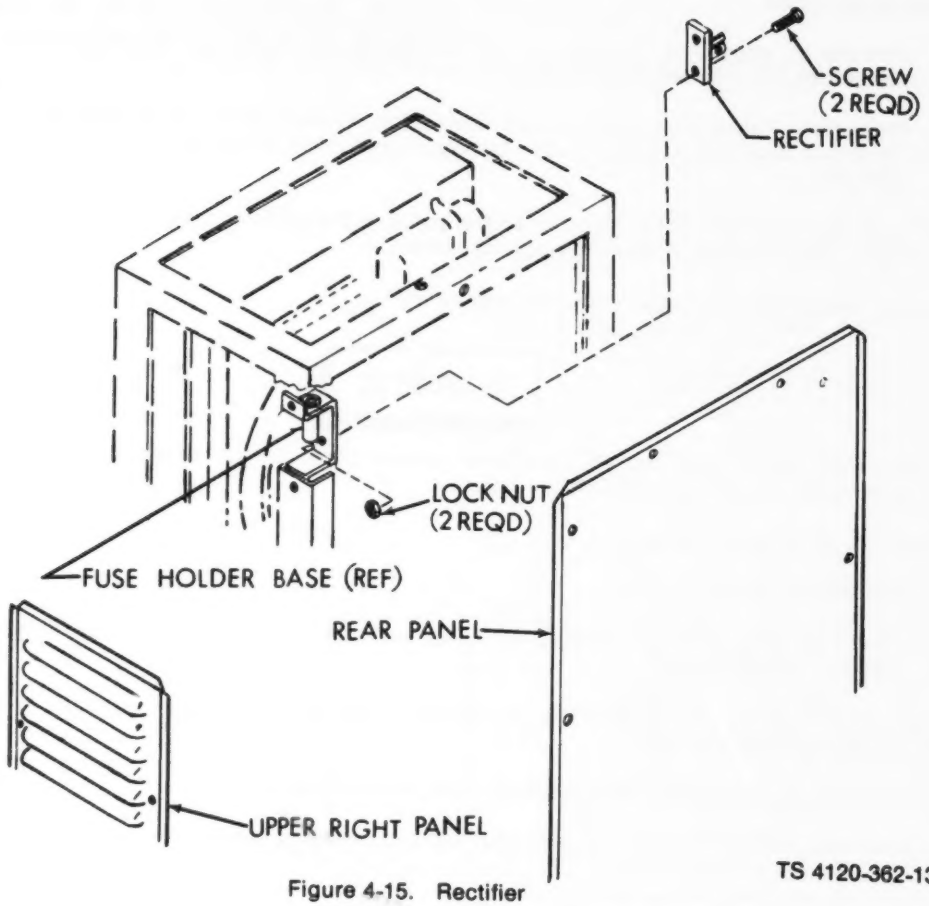

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Figure 4-15. Rectifier

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

(1) Disconnect power.

(2) Tag and unsolder wire leads.

(3) Remove the two screws and nuts.

(4) Remove the rectifier.

d. Installation.

(1) Install the rectifier using two screws and nuts.

(2) Solder wire leads to proper terminals, refer to figure 4-7, wiring diagram. When repairing or installing wires, connections must be made mechanically sound before they are soldered. Solder alone does not provide sufficent strength to prevent breakage. Joining surfaces of connections to be soldered must be clean and bright. If a separate flux is used, it should conform to Specification MIL-F-4995, Type I, resin-alcohol flux, and should be brushed onto the joint before soldering. If a flux-core solder is used, it should always be resin-core electrical solder. If an uncored solder is used, it should be lead-tin solder conforming to Specification QQ-S-571. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive buildup of solder globs on the joint should be avoided or removed.

(4) Install the upper right panel and the rear panel.

(5) Connect power.

4-19. REFRIGERANT PIPING. (CONDENSER SECTION) (figure 4-16).

a. Access. Remove the top, upper right and rear panels and the hood.

b. Inspection of installed items. Inspect tubing and fittings visually for nicks, cuts, cracks, dents and kinks. If damage appears minor, test for leaks. If no leaks are detected and dents and kinks are not severe enough to limit refrigerant flow, consider the tubing serviceable. If a leak or severe dent or kink is found, report to direct support maintenance for repair or replacement.

c. Testing. Test by one of the following methods.

CAUTION

The electronic leak detector is sensitive to the presence of refrigerant gas in the atmosphere. When refrigerant gas is present in the atmosphere of the work area, false indications can result. Use in a well ventilated but draft-free area.

(1) Electronic Leak Detector. Turn the electronic unit on, and slowly pass the probe around all points of the refrigeration system where a leak could exist. Depending upon the type of detector used, a leak will be indicated by an audible signal, a light, or by meter deflections.

(2) Soap Solution. Brush soap solution on all possible points of leakage, and watch for bubbles. Follow a definite sequence to avoid missing any points that should be tested. Wipe the solution from all joints, and mark any point at which a leak is found.

d. Replacement. If test results show any leaks, mark the location and report to direct support maintenance.

4-20. SERVICE VALVE. (CONDENSER SECTION)

The service and line shutoff valve can be used to check pressure or to add refrigerant to the system through the suction line (figure 4-16).

a. Access. Remove rear panel.

b. Inspection/Test of installed items.

(1) Inspect to be sure the caps are in place on the valve stem and the charge connection port.

(2) Test for leaks. See paragraph 4-19c.

c. Replacement. If test results show any leaks, mark location and report to direct support maintenance.

d. Install the rear panel.

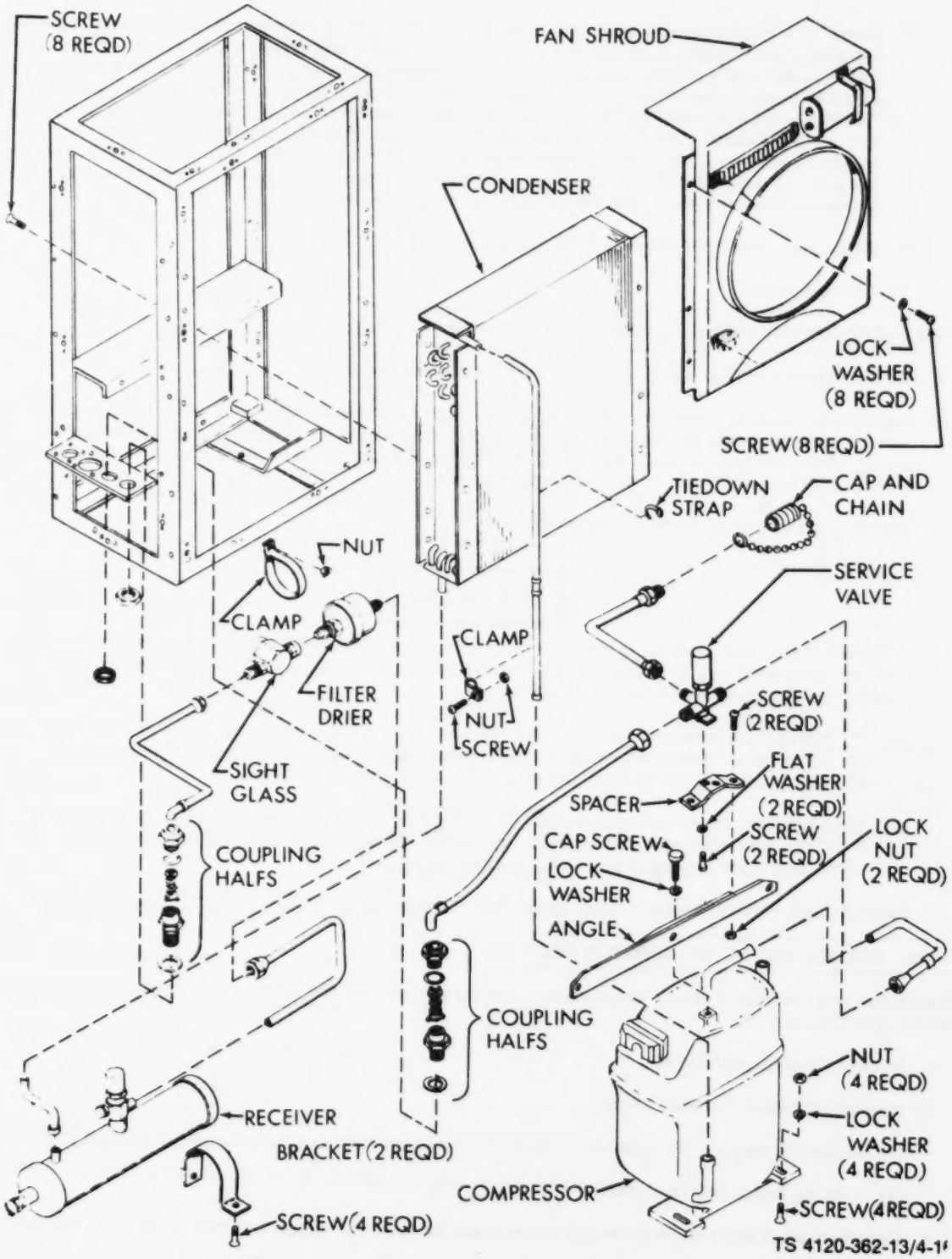

Figure 4-16. Refrigerant Piping, Condenser Section.

4-21. HALF COUPLINGS. (Both Sections)

The half couplings (hose disconnect fittings) used for joining the interconnecting refrigerant hoses, contain a poppet valve assembly to prevent refrigerant loss and to keep air from entering the line when hoses are disconnected. See figure 4-16.

a. Access. Remove hoods and upper panels above hoods from both sections.

b. Inspection of installed items. Check couplings for cracks, breaks, corrosion and loose connections.

c. Test for leaks. See paragraph 4-19c.

d. Replacement. If inspection or test results show any leaks or defects, mark location and report to direct support maintenance.

e. Install hoods and upper panels above the hoods.

4-22. COMPRESSOR. (CONDENSER SECTION)

This is the hermetically sealed type of compressor. It contains a compressor-motor assembly equipped with thermal-overload protection to prevent motor operation above its rated safe operating temperature. See figure 4-16.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. the voltage used can be lethal.

a. Access. Remove the intake air grille, the left side and the rear panels.

b. Inspection of installed items. Inspect for dents, corrosion, breaks, cracks and loose or missing mounting hardware.

c. Cleaning.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38° to 59°C).

Wipe the exterior surface of the compressor with a clean cloth dampened slightly with dry cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

d. Testing.

(1) Check compressor overload protector for an open circuit between terminals 1 and 3 with a continuity tester.

(2) Reset pressure switch by depressing reset button on top panel of condenser section as necessary.

(3) Test terminals S, R and C for continuity with a continuity tester. The compressor must be replaced if there is an open circuit. Refer to direct support maintenance.

(4) Check insulation resistance to ground using a megger. The compressor must be replaced if resistance above 10 megohms is not indicated.

(5) If any damage is evident test for leaks using one of the methods listed in paragraph 4-19c.

e. Replacement. Refer to direct support maintenance.

f. Install the intake air grille, and the left side and rear panels.

4-23. COMPRESSOR START CAPACITOR. (CONDENSER SECTION) (figure 4-17).

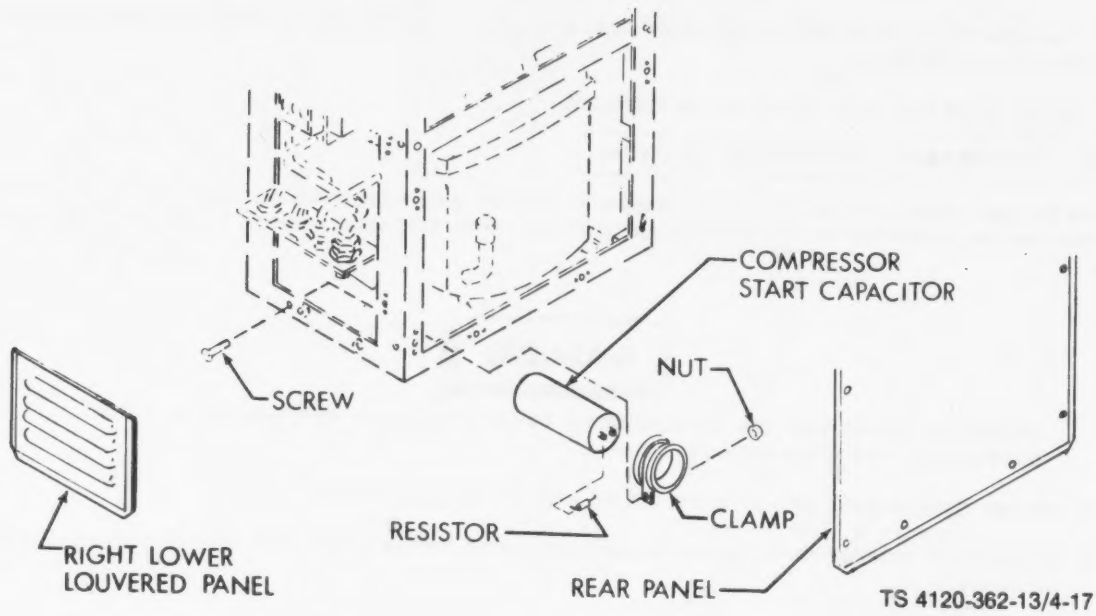

Figure 4-17. Compressor Start Capacitor.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Removal.

(1) Disconnect power.

(2) Remove the right lower louvered panel and the rear panel.

WARNING

Discharge capacitor before touching the two terminals.

(3) Tag and disconnect the leads.

(4) Loosen or remove screw, nut and clamp.

(5) Remove the capacitor.

b. Cleaning. Wipe capacitor with a clean dry cloth.

c. Testing. Test a suspected defective capacitor with a capacitance tester. Replace if found bad. if a capacitance tester is not available, refer to direct support.

d. Installation.

(1) Install capacitor using clamp, screw and nut.

(2) Connect the leads. See figure 4-7, wiring dirgram.

(3) Install the right lower louvered panel and rear panel.

(4) Connect power.

4-24. COMPRESSOR RUN CAPACITOR. (CONDENSER SECTION) (figure 4-18).

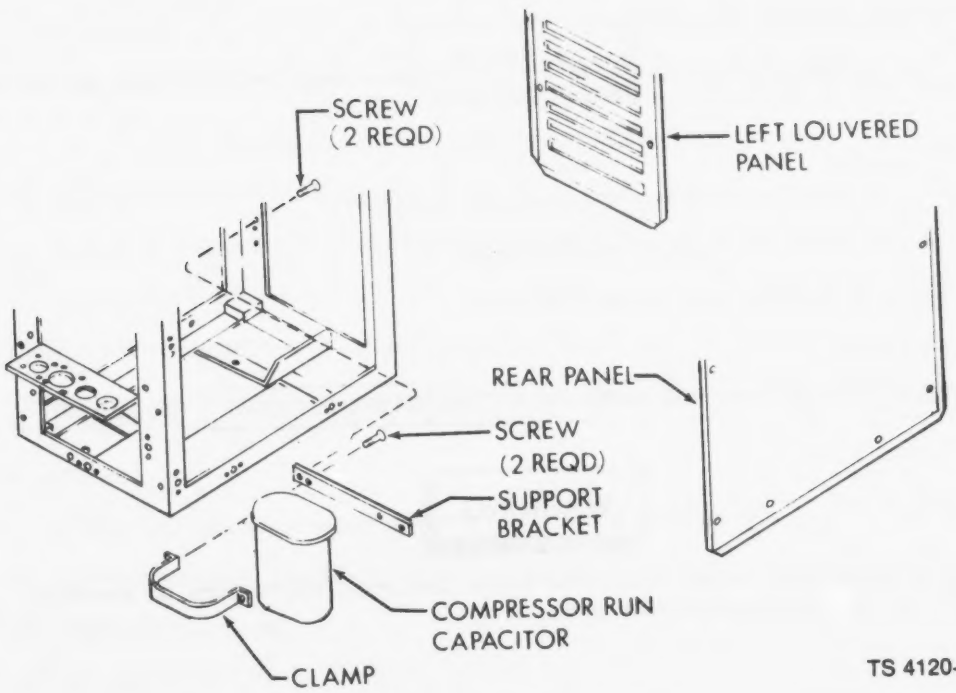

Figure 4-18. Compressor Run Capacitor

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Removal.

(1) Disconnect power.

(2) Remove the left louvered panel and the rear panel.

WARNING

Discharge capacitor before touching the two terminals.

(3) Tag and diconnect the leads.

(4) Disconnect the clamp holding the capacitor to the support bracket by removing two screws.

(5) Remove the capacitor.

b. Cleaning. Wipe capacitor with a clean dry cloth.

c. Testing. Test a suspected defective capacitor with a capacitance tester. Replace if found bad. If a capacitance tester is not available, refer to direct support.

d. Installation.

(1) Position the capacitor and clamp and attach with two screws.

(2) Connect the leads. See figure 4-7, wiring diagram.

(3) Install the left louvered panel and the rear panel.

(4) Connect power.

4-25. CONDENSER FAN MOTOR RUN CAPACITOR (CONDENSER SECTION) (figure 4-19).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Removal.

(1) Disconnect power.

(2) Remove the rear panel.

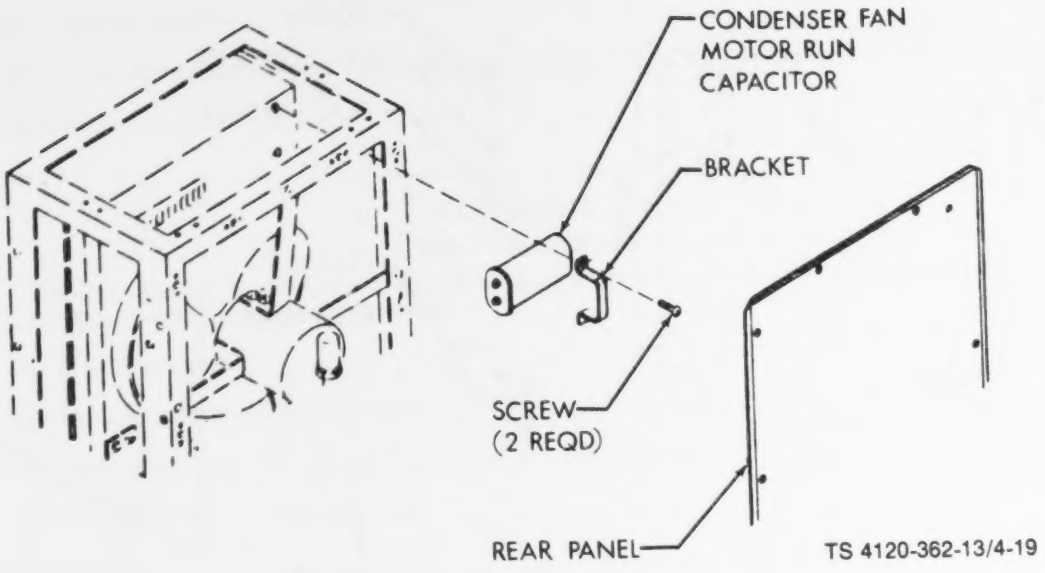

Figure 4-19. Condenser Fan Motor Run Capacitor

WARNING

Discharge capacitor before touching the two terminals.

(3) Tag and disconnect the leads.

(4) Loosen or remove the two screws and the bracket.

(5) Remove the capacitor.

b. Cleaning. Wipe capacitor with a clean dry cloth.

c. Testing. Test a suspected defective capacitor with a capacitance tester. Replace if found bad. If a capacitance tester is not available, refer to direct support.

d. Installation.

(1) Clamp the capacitor in place using the two screws and the bracket.

(2) Connect the leads. See figure 4-7, wiring diagram.

(3) Install the rear panel.

(4) Connect power.

4-26. COMPRESSOR START RELAY. (CONDENSER SECTION) (figure 4-20).

When the compressor motor comes up to speed, this relay eliminates the starting capacitor from the circuit.

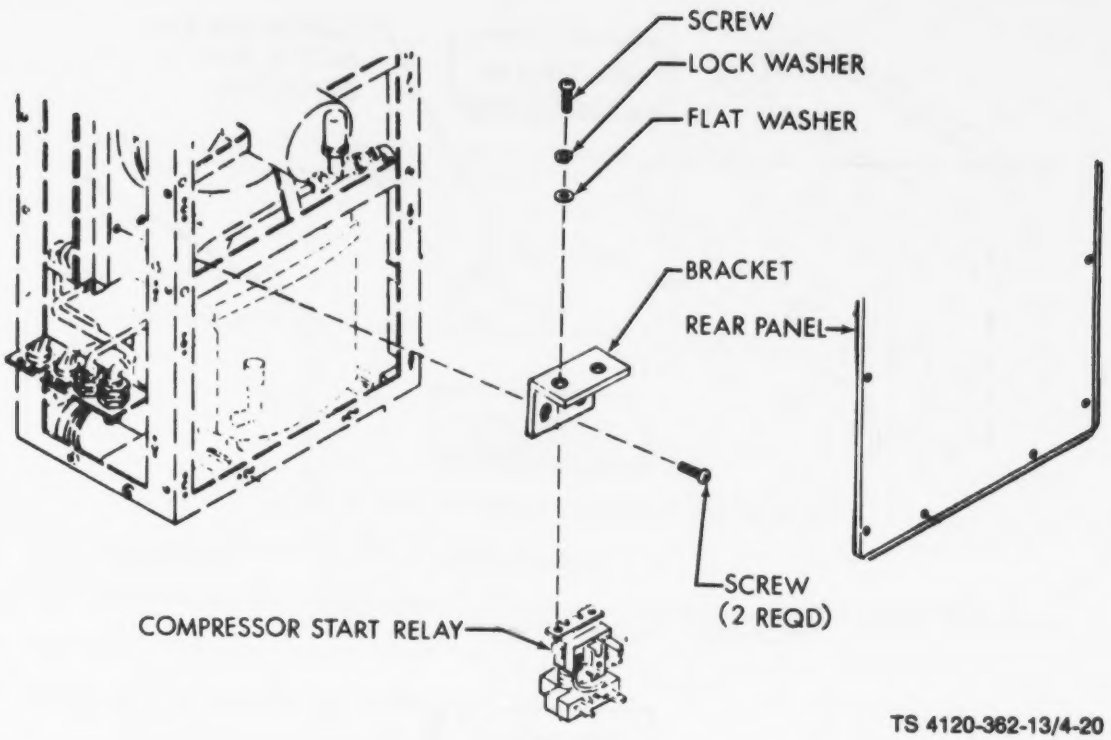

Figure 4-20. Compressor Start Relay.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Access.

(1) Disconnect power.

(2) Remove the rear panel.

b. Inspection/Testing of installed items.

(1) Inspect for breaks, cracks, corrosion, rust and loose connections.

(2) Place the probes of a continuity checker on terminals 5 and 13 on the terminal board and test for continuity. For reference, see wiring diagram, figure 4-7.

WARNING

The following test must be conducted with the power on. Exercise extreme caution.

(3) Connect power.

(4) Check voltage at terminals 4 and 13 on the terminal board. If no voltage exists, replace relay.

c. Removal.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

(1) Disconnect power.

(2) Tag and disconnect the wire leads.

(3) Remove two each of screws, lock washers and flat washers.

(4) Remove the compressor start relay.

d. Installation.

(1) Install the compressor start relay with two each of screws, lockwashers and flat washers.

(2) Connect the wire leads. See figure 4-7, wiring diagram.

(3) Install the rear panel.

(4) Connect power.

4-27. SIGHT GLASS. (CONDENSER SECTION) (figure 4-16).

The sight glass is located under the condenser just behind the condenser intake grille. The condition of the liquid refrigerant is seen through this glass when the unit is in the cooling mode.

a. Access. Remove the intake air grille (figure 4-8).

b. Inspection/Test of installed items.

(1) Inspect for cracked or broken glass, leaks and corrosion. If glass is cracked or broken, refer to direct support maintenance.

(2) If a leak is indicated, test per paragraph 4-19c.

c. Replacement. If inspection/test results indicate replacement, refer to direct support maintenance (para 5-9).

d. Install the intake air grille.

4-28. RECEIVER. (CONDENSER SECTION) (figure 4-16).

The receiver consists of a steel container for collecting the high pressure liquid refrigerant from the condenser coil. The valve on top of the receiver can be used for releasing the refrigerant charge. The valve must be backseated before operating the unit.

a. Access. Remove the intake air grille. See figure 4-8.

b. Inspection/Test of installed items.

(1) Clean receiver and valve with a clean dry cloth and check for leaks, cracks, corrosion or other defects. Make sure fusible plug is secure in receiver end.

(2) Make sure seal cap is on the flare connection.

(3) Make sure valve stem cap is ON.

(4) If a leak is indicated, test per paragraph 4-19c.

c. Replacement. If inspection/test results indicate replacement, refer to direct support maintenance (para 5-11).

d. Install the intake air grille.

4-29. CONDENSER COIL. (CONDENSER SECTION) (figure 4-16).

This coil consists of copper tubing and has aluminum fins which transfer heat from the refrigerant to the air.

a. Access (figures 4-8 and 4-9). Remove the following grilles and panels, discharge air grille, right upper louvered panel, left louvered panel and the rear panel.

b. Inspection/Test of installed items.

(1) Check for accumulated dirt. Clean if an accumulation of dirt is evident.

(2) Check fins for dents, bent edges or any condition that would block or distort air flow. Straighten all damaged fins with a plastic fin comb.

(3) If a leak is indicated, test per paragraph 4-19c.

WARNING

Compressed air used for cleaning purposes will not exceed 30 PSI.

c. Cleaning. Clean coil with a soft bristled brush, or use compressed air at 30 psi or less from the inside of the coil to blow the dirt out. Take care to avoid fin damage.

d. Repair/Replacement. If inspection/test results indicate repairs or replacement, refer to direct support maintenance (para 5-12).

e. Install the following grilles and panels, discharge air grille, right upper louvered panel, left louvered panel and the rear panel.

4-30. FRAME. (CONDENSER SECTION)

a. Access. Remove all panels, grilles and the hood. See figures 4-8 and 4-9.

b. Inspection/Test of installed item.

(1) Check for missing, loose or damaged hardware. Replace all hardware found missing or defective.

(2) Inspect for dents, bends and cracked or broken welds. Refer defective condition to direct support maintenance.

c. Repair. Refer all repairs other than hardware replacement to direct support maintenance.

d. Install all panels, grilles and the hood. See figures 4-8 and 4-9.

4-31. PANELS, GRILLES AND HOOD. (EVAPORATOR SECTION) (figures 4-21 and 4-22).

The evaporator section is housed within metal panels and adjustable grilles or louvers. Quick release 1/4 turn stud fasterners permits easy removal of panels. The hood is retained by standard machine screws.

a. Removal. Remove the panels that have quick release 1/4 turn stud fasteners by turning the fasteners 1/4 turn counterclockwise and pulling the panel outward.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

b. Cleaning. Clean the panels with a cloth dampened with a detergent solution or dry cleaning solvent (Fed Spec P-D-680). Use a soft brush if necessary to dislodge caked on dirt. Dry the items thoroughly.

c. Inspection/Repair. Inspect panels for breaks, cracks, dents, loose or missing mounting hardware or other defects. Repair breaks, cracks and dents using conventional steel metal repair methods. Replace missing mounting hardware and panels damaged beyond repair. Inspect the identification plate rivets to the outside of the upper left panel for legibility and obvious damage. Replace it if you cannot read all of the information shown on the plate. Inspect gasket material, using the following procedure:

(1) Remove as much old gasket material as possible by pulling or scraping it away from the metal surface.

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable and their vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use a well ventilated area, wear gloves, and keep away from sparks or flame.

(2) Soften and remove old adhesive and gasket residue, using acetone or methyl-ethyl ketone (MEK) and a stiff brush.

(3) Coat the mating surfaces of the metal and the gasket with adhesive. Let both surfaces air dry until the adhesive is tacky but will not stick to the fingers.

(4) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

d. Painting. If either touch up or refinishing is necessary, see TM43-0139.

e. Installation.

(1) If the identification plate was removed, reinstall with rivets.

(2) If the electrical connector covers were removed, reinstall with rivets.

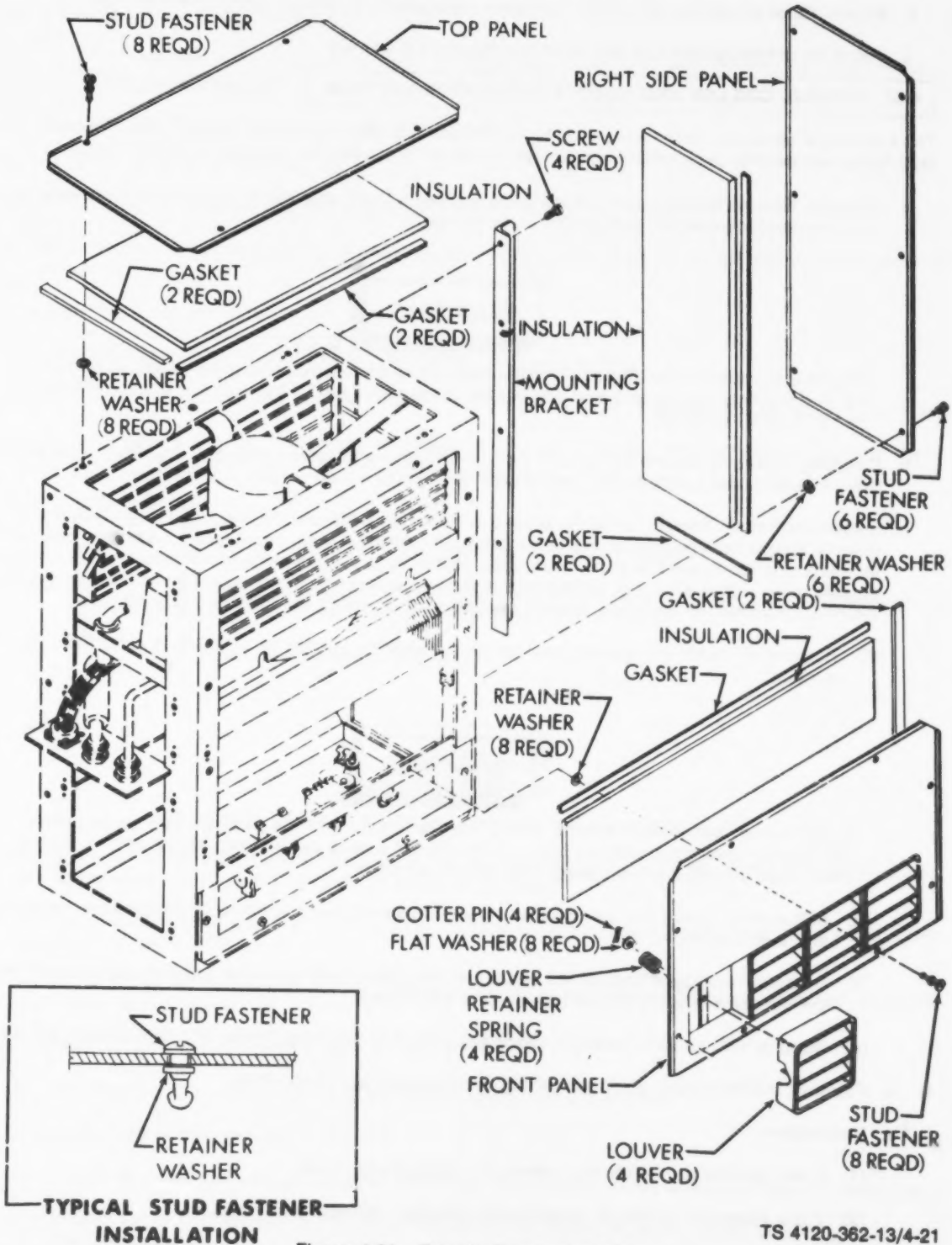

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Figure 4-21. Panels, Evaporator Section (Top, Right Side and Front)

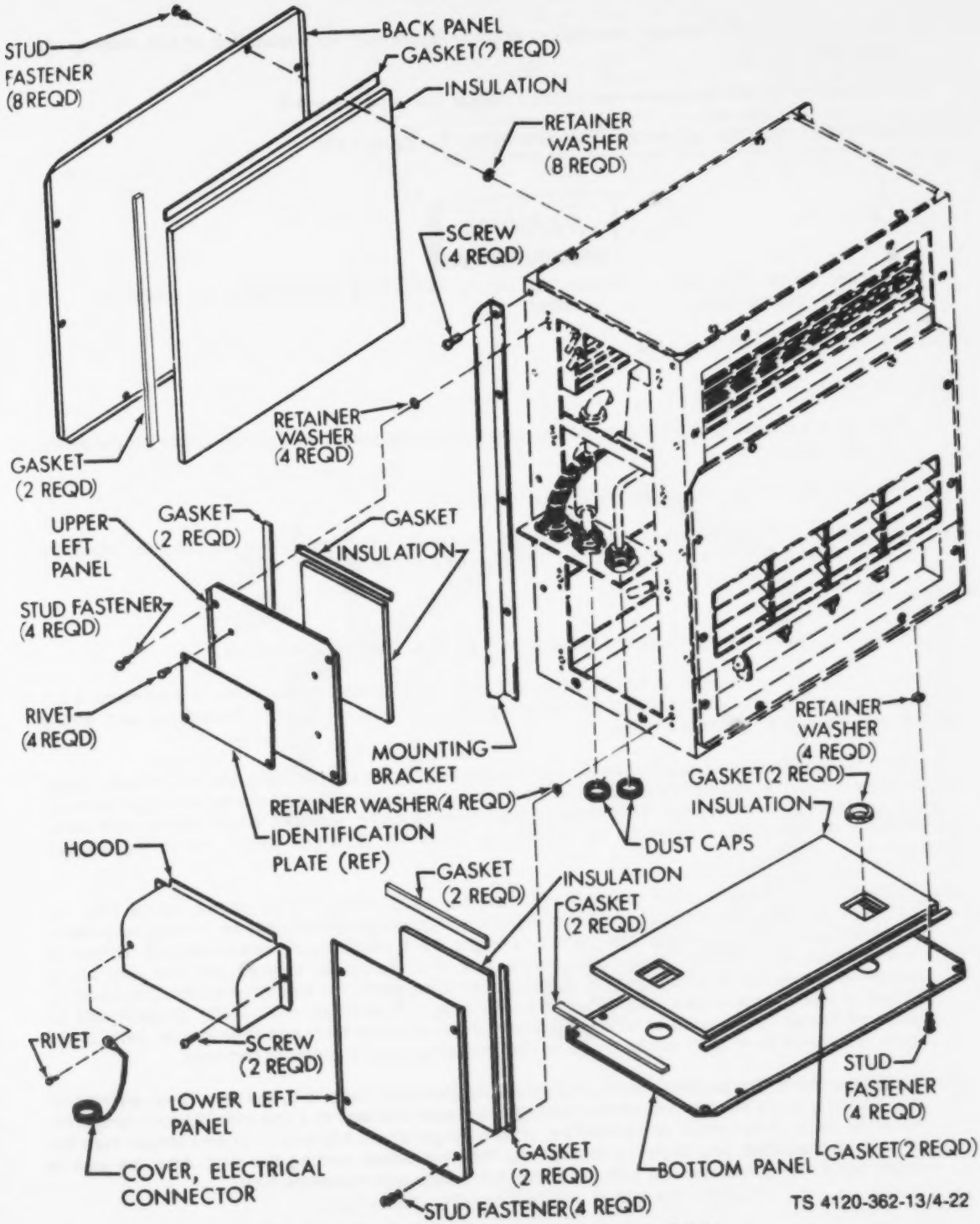


Figure 4-22. Panels and Hood, Evaporator Section (Left side, Back and Bottom)

(3) Attach the hood with machine screws.

(4) See the typical stud fastener installation detail in figure 4-21 for installation of any missing stud fasteners.

(5) Position the remaining panels and engage the 1/4 turn stud fasteners.

4-32. ELECTRICAL WIRING. (EVAPORATOR SECTION) (figure 4-23).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Access. See figures 4-21 and 4-22.

(1) Disconnect power.

(2) Remove the following outside panels: top panel, right side panel, front panel, upper left panel and the back panel.

(3) Remove the hood by unscrewing two machine screws.

(4) Release the 1/4 turn studs on the control panel and carefully pull the control panel out far enough to gain access to the wire connections on the back side of the panel.

b. Inspection.

(1) Inspect connector for damage and loose or broken pins. Replace if defective.

c. Testing. Using wiring diagram in figure 4-5, check individual wires for continuity. If continuity is not indicated, check solder and terminal lug connections and condition of wire. Repair all bad solder connections and replace all damaged wires.

d. Repair or Replace. Preferred repair methods consist of replacing wires, terminals, connectors, etc., rather than splicing wires, bending ends to form terminals, and other make shift procedures, although the latter may be appropriate for emergency field repairs. Determine the proper size and length of wire, terminal or connector to be used for replacement by referring to Table 4-5, Wire List, and to the wiring diagram (figure 4-7).

(1) Soldering Connections. Wire connections must be made mechanically sound before they are soldered; solder alone does not provide sufficient strength to prevent breakage. Joining surfaces of connections to be soldered must be clean and bright. If a separate flux is used, it should conform to Specification MIL-F-4995, Type I, resin-alcohol flux, and should be brushed onto the joint before soldering. If a flux-core solder is used, it should always be resin-core electrical solder. If an uncored solder is used, it should be a lead-tin solder conforming to Specification QQ-S-571. Wires should always be heated to the point at which the solder will melt completely and flow into all parts of the joint. Excessive buildup of solder globs on the joint should be avoided or removed.

(2) Insulating Joints. The preferred method of insulating electrical joints is by the use of heat-shrink tubing. To apply, cut a piece of heat-shrink tubing of suitable diameter to a one-inch (2.54cm) length for covering joints at terminals or connectors, or to a length about 1/2-inch (1.27 cm) longer than the joint to be insulated, and slide the tubing over the wire before making the joint. After the joint is made, slide the tubing over the joint, and shrink in place with moderate heat.

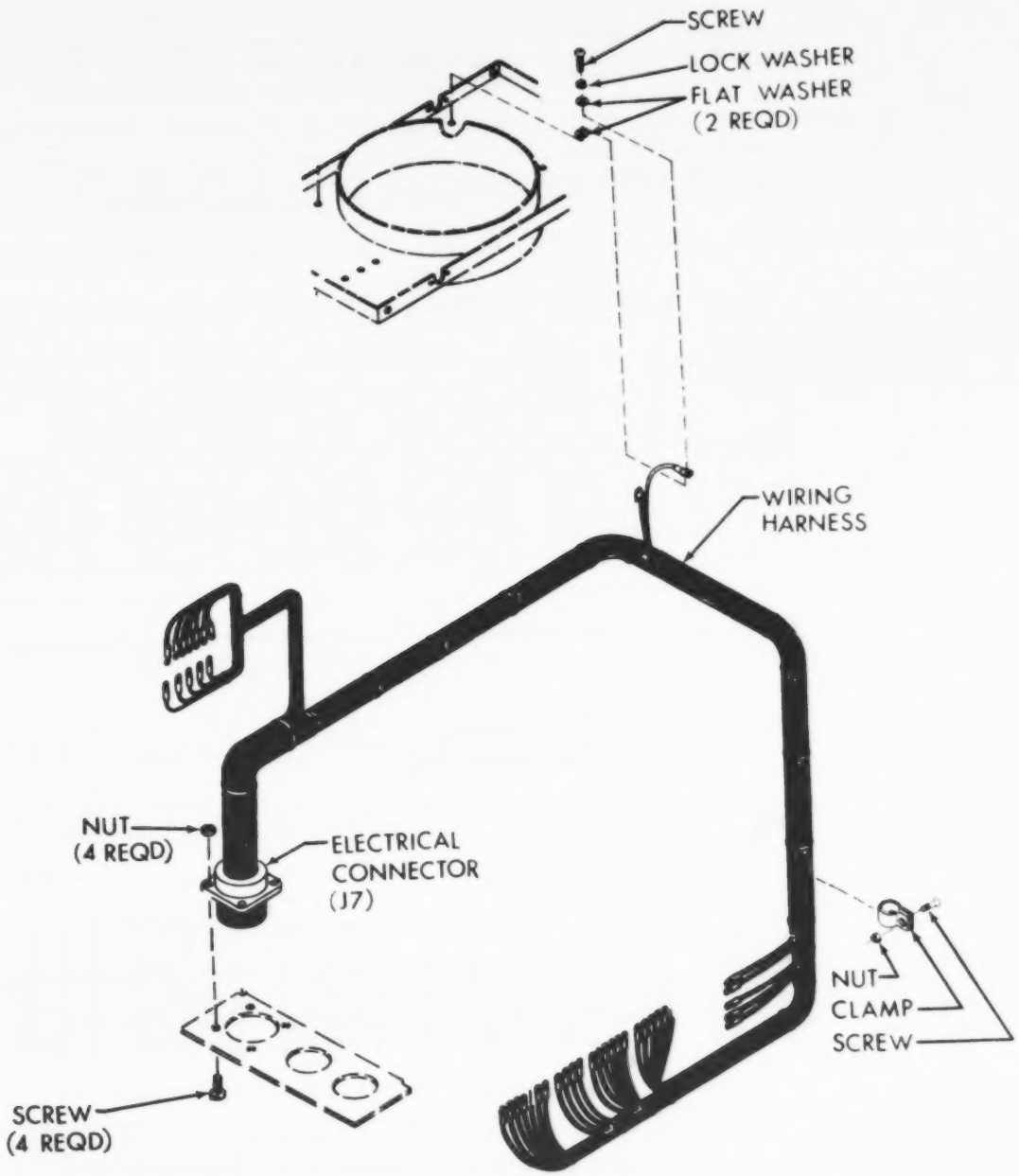


Figure 4-23. Wiring Harness, Evaporator Section

TABLE 4-5 WIRE LIST EVAPORATOR SECTION

Ident. No. (Marketing)	TERMINATION		TERMINATION		Awg Wire Size	LENGTH	
	From	Terminal Type	To	Terminal Type		IN.	CM.
		WIRING HARNESS EVAPORATOR SECTION					
65	J7-A	MS3102R22-19P	S3-9	MS25036-106	16	48	121.9
66	J7-B	MS3102R22-19P	S3-6	MS25036-106	16	48	121.9
67	J7-C	MS3102R22-19P	S3-3	MS25036-106	16	49	124.5
68	J7-D	MS3102R22-19P	GRD	MS25036-108	16	27	68.6
69	J7-G	MS3102R22-19P	K4-11	MS25036-106	16	15	38.1
70	J7-H	MS3102R22-19P	S2-3	MS25036-106	16	50	127.0
71	J7-J	MS3102R22-19P	K4-10	MS25036-106	16	16	40.6
72	J7-K	MS3102R22-19P	S2-12	MS25036-106	16	49	124.5
73	J7-M	MS3102R22-19P	S2-9	MS25036-106	16	49	124.5
74	J7-P	MS3102R22-19P	S2-6	MS25036-106	16	50	127.0
75	S2-11	MS25036-106	K4-2	MS25036-106	16	51	129.5
76	S2-8	MS25036-106	K4-5	MS25036-106	16	52	132.1
77	S2-5	MS25036-106	K4-8	MS25036-106	16	53	134.6
78	S2-2	MS25036-153	S4-2	MS25036-106	16	9	22.9
79	S4-1	MS25036-153	S3-12	MS25036-106	16	12	30.5
80	S4-3	MS25036-153	S5-1	MS25036-106	16	19	48.3
81	S5-2	MS25036-106	S3-10	MS25036-106	16	14	35.6
82	S3-7	MS25036-106	HR1-6	MS25036-153	16	15	38.1
83	S3-4	MS25036-106	HR1-2	MS25036-153	16	14	35.6
84	S3-1	MS25036-106	HR1-1	MS25036-153	16	14	35.6
85	S3-11	MS25036-106	K4-7	MS25036-106	16	52	138.1
86	S3-8	MS25036-106	K4-3	MS25036-106	16	50	127.0
87	S3-5	MS25036-106	K4-4	MS25036-106	16	51	129.5
88	S3-2	MS25036-106	K4-9	MS25036-106	16	51	129.5
89	K4-8	MS25036-106	C1	41532 (00779)	16	30	76.2
94	K4-11	MS25036-106	K4-6	MS25036-106	16	8	20.3
95	HR1-1	MS25036-153	HR1-3	MS25036-153	16	3	7.6
96	HR1-3	MS25036-153	HR1-5	MS25036-153	16	3	7.6
97	HR1-2	MS25036-153	HR1-4	MS25036-153	16	3	7.6

(3) Splicing Wires. To repair broken or cut wires that are otherwise sound, the mating ends can be stripped and spliced. A commercial butt splice can be crimped onto the ends to join them, or a Western Union wire splice can be made. The latter is made by stripping 1-1/4 inch (3.18 cm) of insulation from the wire ends, holding the ends parallel and facing opposite directions, then twisting each end around the other wire at least three turns. Solder and apply insulation as described above.

(4) Crimping Terminals. To install a terminal on the end of a wire, strip 1/4 to 1/2 inch (0.66 to 1.27 cm) of insulation from the end of the wire, apply a one-inch (2.54 cm) piece of heat-shrink tubing (if the terminal is of the uninsulated type), and insert wire-end into the shank of the terminal. Crimp the shank, and install heat-shrink tubing if necessary.

e. Reassembly.

(1) Carefully position the control panel in place and engage the 1/4 turn stud fasteners.

(2) Attach the hood with two machine screws.

(3) Reinstall the following outside panels: two panel, right side panel, front panel, upper left panel and the back panel.

(4) Connect power.

4-33. CONTROL PANEL. (EVAPORATOR SECTION) (figure 4-24).

The control panel is located toward the bottom of the front of the evaporator section. It contains one mechanical switch and three electrical switches.

a. Inspection/Test of installed items. Inspect for dents, damaged or missing parts on hardware and proper operation of fresh and return air louver switch. Make repairs and replace missing parts.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

b. Removal.

(1) Disconnect power.

(2) Remove the front panel. See figure 4-21.

(3) Release the 1/4 turn stud fasteners and carefully pull the control panel out far enough to gain access to the parts on the back of the panel.

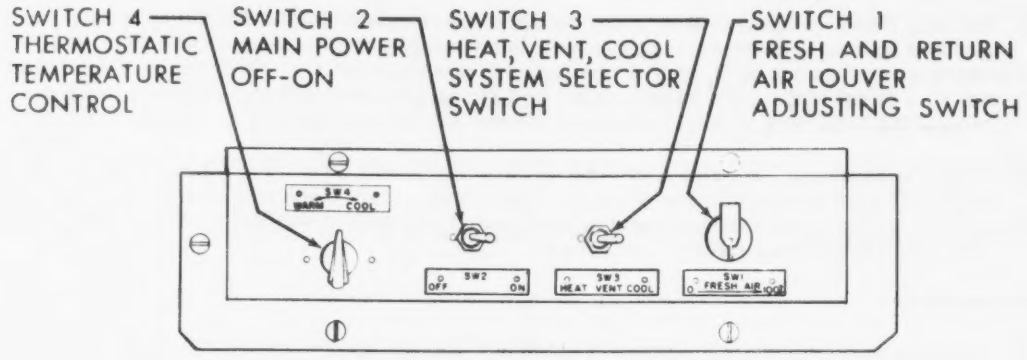
(4) Remove/loosen setscrews on knobs and pull knobs off.

(5) Remove screws from switches 1 and 4 and nuts and washers from switches 2 and 3. Carefully remove the control panel from the switches.

WARNING

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).



CONTROL PANEL

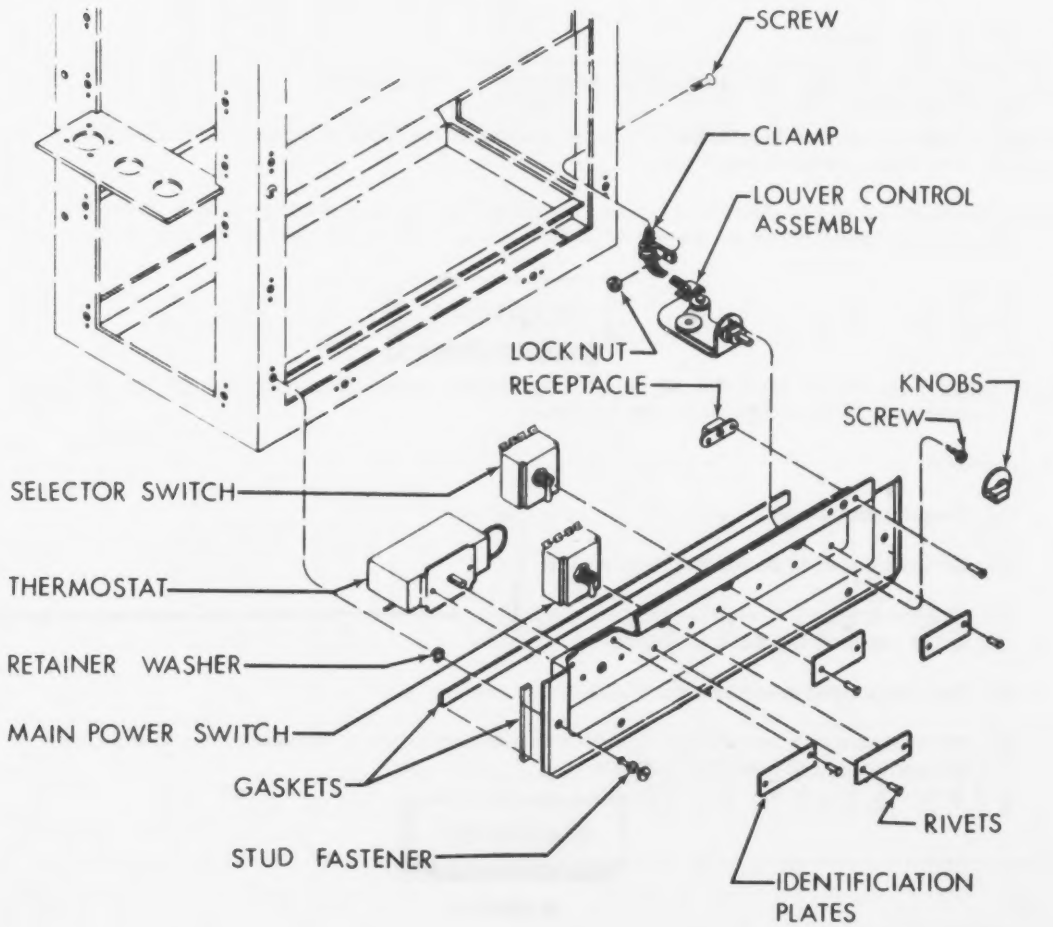


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Figure 4-24. Control Panel.

c. Cleaning. Clean the control panel with a cloth dampened with a detergent solution or dry cleaning solvent (Fed Spec P-D-680). Use a soft brush if necessary to dislodge caked-on dirt. Dry the items thoroughly.

d. Inspection/Repair. Inspect the control panel for breaks, cracks, dents or loose or missing mounting hardware or other defects. Repair breaks, cracks and dents using conventional sheet metal repair methods. Replace missing mounting hardware and panel if damaged beyond repair. Inspect the identification plates riveted to the outside of the panel for legibility and obvious damage. Replace them if you cannot read all of the information shown on the plates. Inspect gasket material for hardening, permanent set, cuts, tears or missing pieces. If necessary to replace gasket material, use the following procedure:

(1) Remove as much old gasket material as possible by pulling or scraping it away from the metal surface.

WARNING

Acetone and methyl-ethyl ketone (MEK) are flammable, and their vapors can be explosive. Repeated or prolonged skin contact or inhalation of vapors can be toxic. Use a well ventilated area, wear gloves, and keep away from sparks or flame.

(2) Soften and remove old adhesive and gasket residue, using acetone or methyl-ethyl ketone (MEK) and a stiff brush.

(3) Coat the mating surfaces of the metal and the gasket with adhesive. Let both surfaces air dry until the adhesive is tacky but will not stick to the fingers.

(4) Starting with an end, carefully attach the gasket to the metal. Press into firm contact all over.

e. Painting. Should touch up or refinishing be necessary, see TM43-0139.

f. Reassembly/Installation.

(1) If identification plates were removed, install new plates with rivets.

(2) Position switches in proper holes and attach switches 1 and 4 with screws and switches 2 and 3 with nuts and washers. Tab and key type washers must be alined with switch shaft and holes in control panel.

(3) Place knobs on shafts of switches 1 and 4 and tighten set screws. Take care to match knob pointers with information shown on identification plates.

(4) Carefully position the control panel in place and engage the 1/4 turn stud fasteners.

(5) Reinstall the front panel.

(6) Connect power.

4-34. MAIN POWER OFF-ON SWITCH 2 (figure 4-25).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

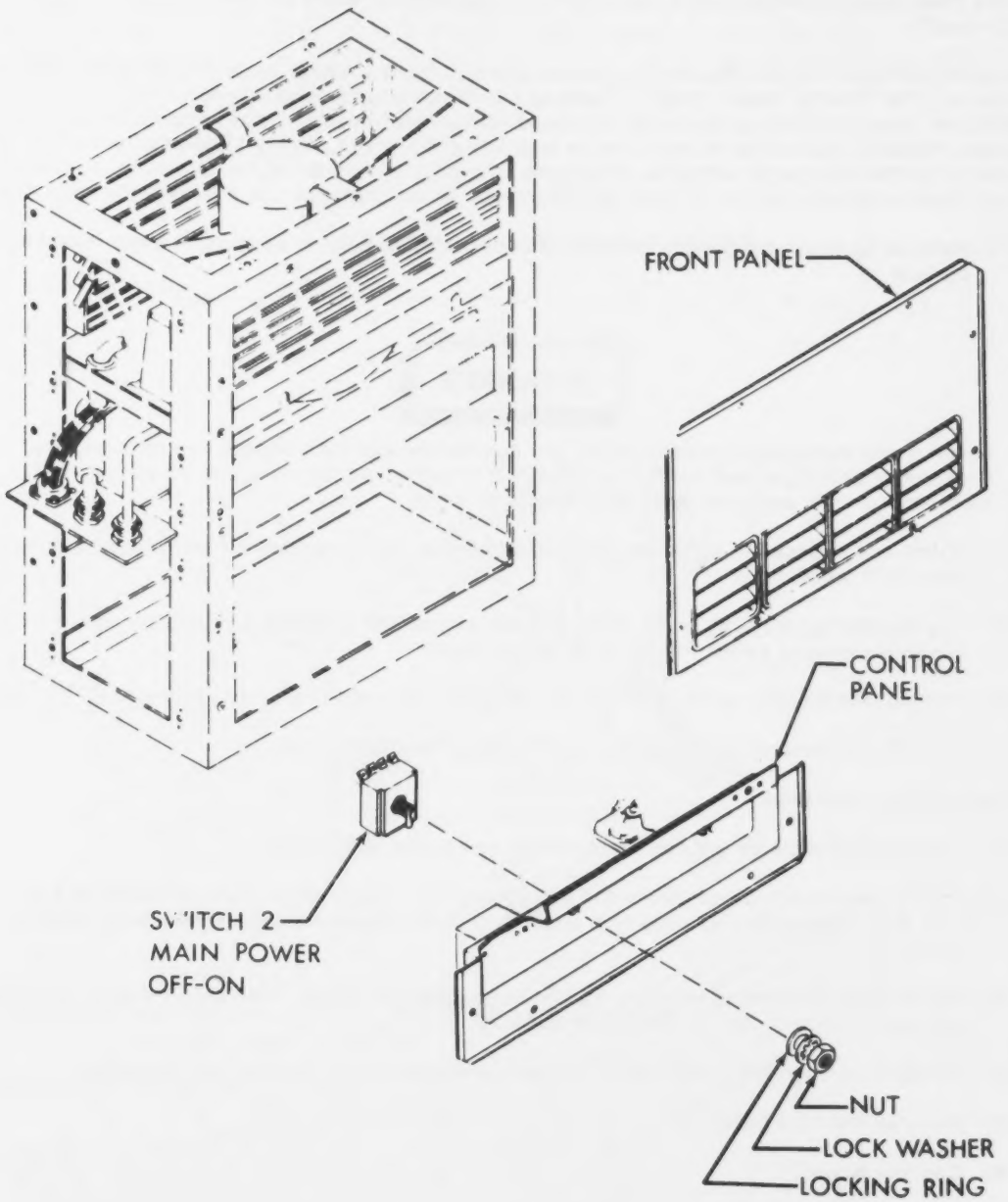

Figure 4-25. Main Power Off-On Switch 2.

a. Access.

(1) Disconnect power.

(2) Remove the front panel.

(3) Release the 1/4 turn stud fasteners and carefully pull the control panel out far enough to gain access to the parts on the back of the panel.

b. Testing.

(1) Place switch in the ON position.

(2) Touch the probes of a continuity tester to terminals 2 and 3, 5 and 6, 8 and 9 and 11 and 12. Each pair of terminals should indicate continuity. If this test does not indicate continuity, the switch is defective and should be replaced.

c. Removal.

(1) Tag and remove wire leads.

(2) Remove nut, lock washer and locking ring.

(3) Remove switch.

d. Installation.

(1) Assemble switch to control panel using nut, lock washer and locking ring supplied with switch. Tab and Key type washers must be alined with switch shaft and holder in control panel.

(2) Connect wire leads. See figure 4-7, wiring diagram.

(3) Carefully position the control panel in place and engage the 1/4 turn stud fasteners.

(4) Reinstall the front panel.

(5) Connect power.

4-35. HEAT, VENT, COOL SYSTEM SELECTOR SWITCH 3 (figure 4-26).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Access.

(1) Disconnect power.

(2) Remove the front panel.

(3) Release the 1/4 turn stud fasteners and carefully pull the control panel out far enough to gain access to the parts on the back of the panel.

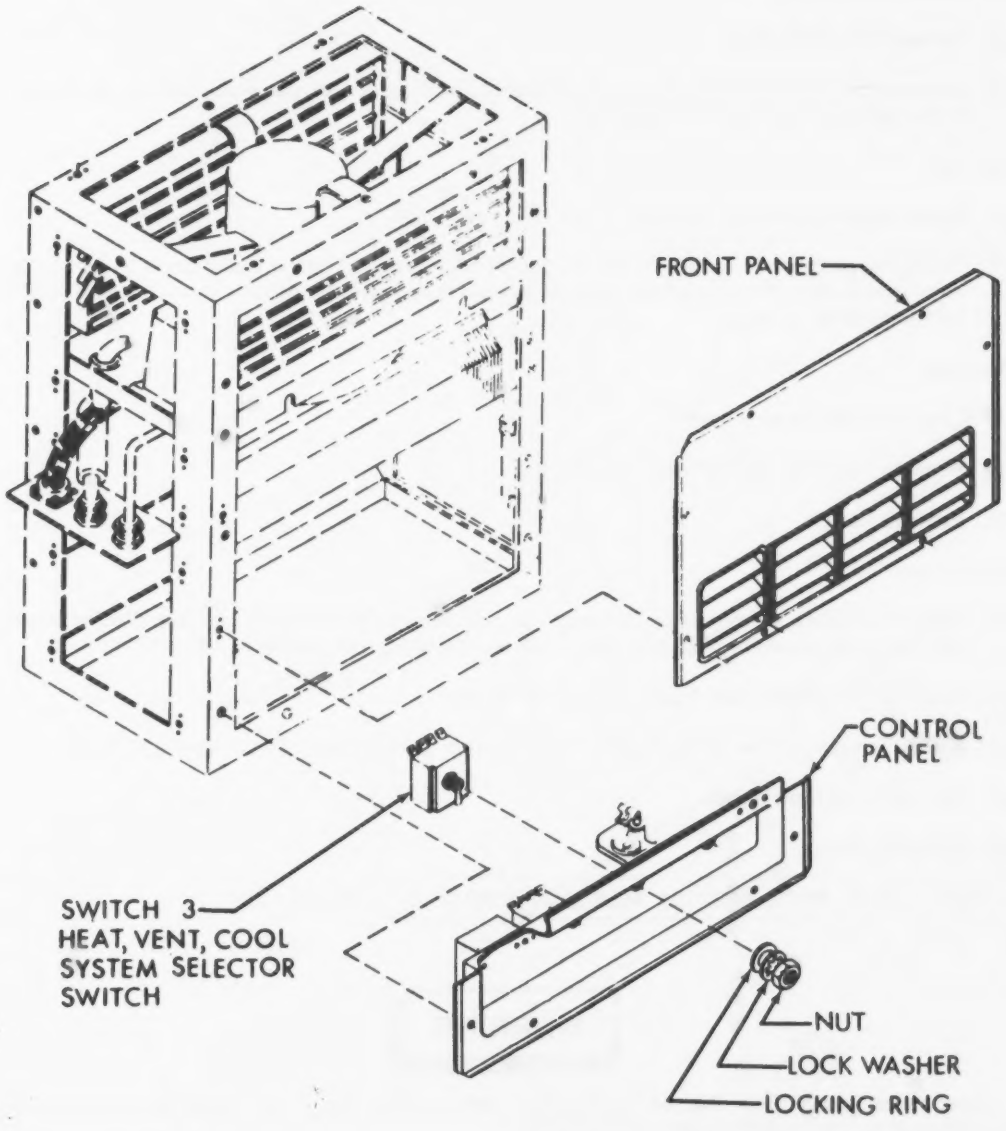

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Figure 4-26. Heat, Vent, Cool System Selector Switch 3.

b. Testing.

(1) Place switch in COOL position.

(2) Touch probes of a continuity tester to terminals 2 and 3, 5 and 6, 8 and 9 and 11 and 12. Each pair of terminals should indicate continuity.

(3) Place switch in HEAT position.

(4) Touch the probes of a continuity tester to terminals 1 and 2, 4 and 5, 7 and 8 and 10 and 11. Each pair of terminals should indicate continuity. If they do not, the switch is defective and should be replaced.

c. Removal.

(1) Tag and remove wire leads.

(2) Remove nut, lock washer and locking ring.

(3) Remove switch.

d. Installation.

(1) Assemble switch to control panel using nut, lock washer and locking ring supplied with switch. Tab and key type washers must be alined with shaft and holes in control panel.

(2) Connect wire leads. See figure 4-7, wiring diagram.

(3) Carefully position the control panel in place and engage the 1/4 turn stud fasteners.

(4) Reinstall the front panel.

(5) Connect power.

4-36. THERMOSTATIC TEMPERATURE CONTROL SWITCH 4 (figure 4-27).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Access.

(1) Disconnect power.

(2) Remove the front panel.

(3) Release the 1/4 turn stud fasteners and carefully pull the control panel out far enough to gain access to the parts on the back of the panel.

b. Testing.

(1) Place switch SW3 in COOL position.

(2) Touch probes of continuity tester to terminals 1 and 2 of thermostat which should indicate continuity.

(3) Rotate the thermostatic switch towards the warm position until a click is heard in the switch.

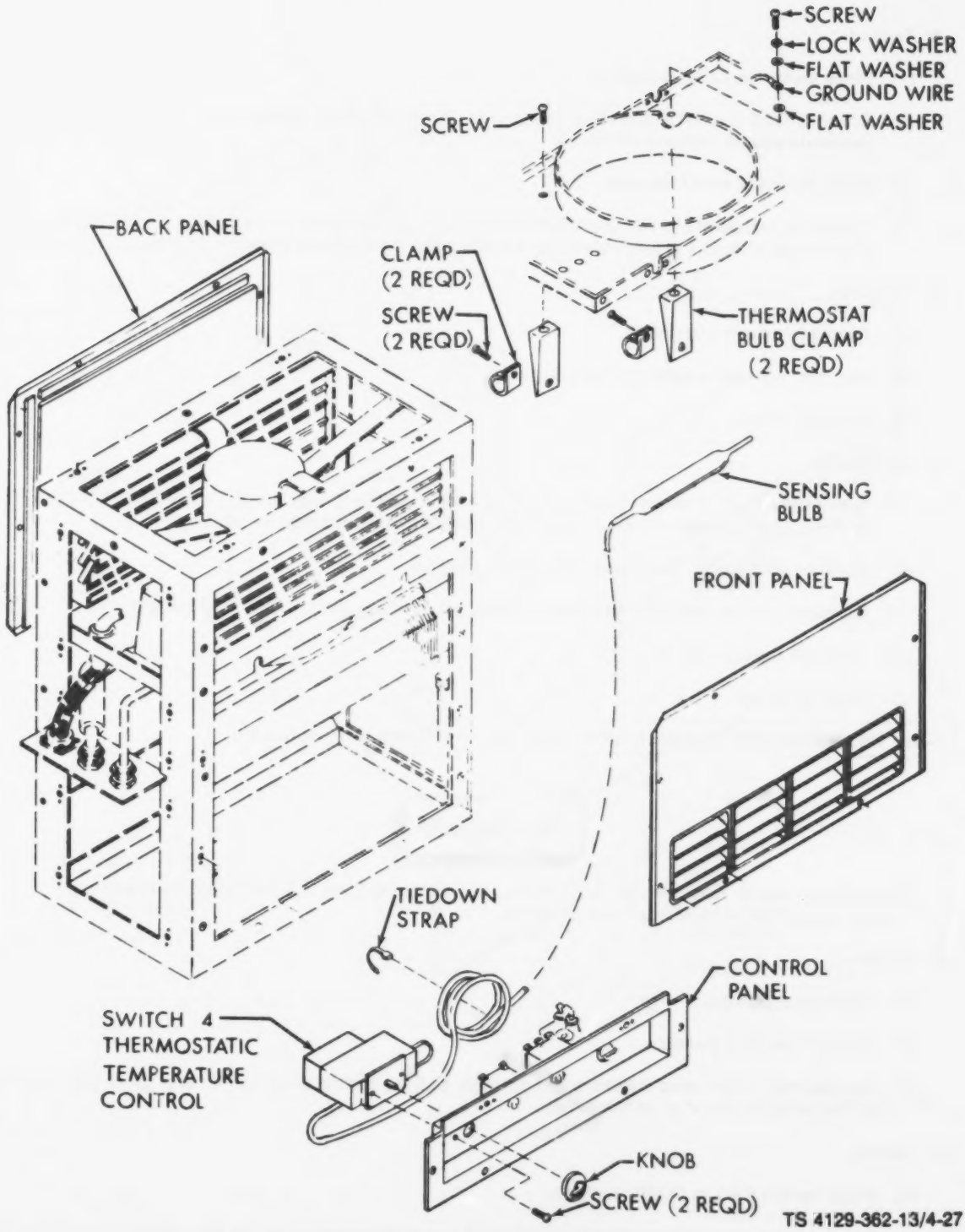

Figure 4-27. Thermostatic Temperature Control Switch 4.

(4) Touch the probes of the continuity tester to terminals 2 and 3, which should indicate continuity. If continuity is not indicated, the switch is defective and should be replaced.

c. Removal.

(1) Tag and remove wire leads.

(2) Loosen setscrews on knob and remove knob.

(3) Remove screws and pull the switch from the control panel.

(4) Remove the back panel.

(5) Loosen the screws holding the sensing bulb clamps and carefully remove the sensing bulb from the clamps.

(6) Remove the tie down strap from the capillary line.

(7) Remove the thermostatic temperature control switch from the unit.

d. Installation.

(1) Carefully position the thermostatic switch in the unit.

(2) Slip the sensing bulb in the clamps and tighten the clamp screws.

(3) Carefully coil the capillary line and secure to the tubing close to the end of the sensing bulb with a new tie down strap or electrical tape.

(4) Install the two screws into the switch.

(5) Place the knob on the switch shaft and tighten the setscrew. Take care to match the knob pointer with information shown on the identification plate.

(6) Connect wire leads. See figure 4-7, wiring diagram.

(7) Carefully position the control panel in place and engage the 1/4 turn stud fasteners.

(8) Reinstall the front and back panels.

(9) Connect power.

4-37. FRESH AND RETURN AIR LOUVER SWITCH 1 AND FRESH AND RETURN DAMPER ASSEMBLY (figure 4-28).

WARNING

Disconnect power from the air conditioner before performing maintenance on internal components. The voltage used can be lethal.

a. Access.

(1) Disconnect power.

(2) Remove the following panels: top, right side, front, upper left and back. See figures 4-21 and 4-22.

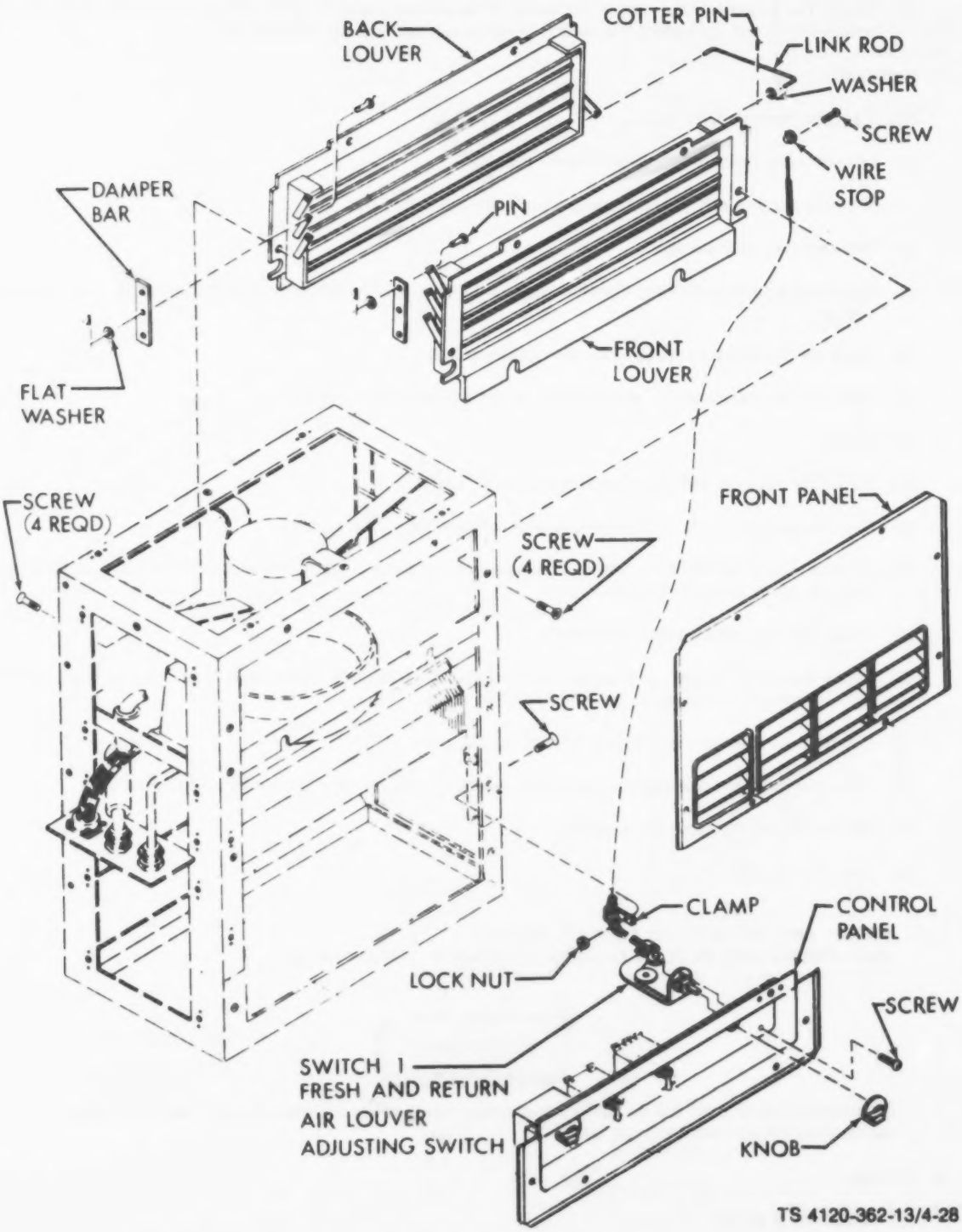

Figure 4-28. Fresh and Return Air Louvers and Switch.

b. Inspection/Test of installed items.

(1) Inspect for loose, damaged or missing parts or hardware. Replace missing or defective parts and tighten loose hardware.

(2) Inspect louvers for dents, bent or broken blades, broken welds and proper operation when control switch is adjusted. Repair minor damage. Replace if damage hinders operation of louvers.

c. Removal of adjusting switch.

(1) Release the 1/4 turn stud fasteners and carefully pull the control panel out far enough to gain access to the parts on the back of the panel.

(2) Loosen the setscrew and remove the knob.

(3) Remove the screw and pull the switch from the control panel.

(4) Remove the screw, clamp and nut holding the control wire housing in place.

(5) Loosen the wire stop screw and remove the end of the wire from the wire stop.

(6) Remove the fresh and return air louver adjusting switch from the unit.

d. Removal of the louvers.

(1) Remove the two cotter pins and washers from the link rod and remove the link rods.

(2) Remove the four screws from each of the louvers and remove the louvers.

e. Cleaning.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

Clean the adjustable louvers and control switch with a dry cleaning solvent (Fed Spec P-D-680). Use a soft brush if necessary to dislodge caked on dirt. Dry the parts thoroughly.

f. Lubricate the louvers by applying a drop of oil on any surface where friction might develop. The only maintenance required is an occasional drop of oil on these surfaces.

g. Reassembly/Installation.

(1) Install both the front and back louvers with four screws each.

(2) Slip the ends of the link rod into holes in the damper arm and retain with two each of the washers and cotter pins.

(3) Position the fresh and return air louver adjusting switch in the unit.

(4) Connect the end of the control wire to the front damper using a screw and wire stop.

(5) Attach the switch housing to the control panel with a screw.

(6) Slip the knob onto the switch shaft and tighten the setscrew.

(7) Carefully position the control panel in place and engage the 1/4 turn stud fasteners.

(8) Install a clamp, screw and nut to retain the control wire housing.

(9) Loosen the screw in the wire stop and the set screw in knob and adjust louvers so that the information on the switch plate matches the knob pointer. Tighten the screw and set screw.

(10) Install the following panels: top, right side, front, upper left and back.

(11) Connect power.

4-38. EVAPORATOR FAN (figure 4-29).

a. Removal.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the following panels: top, right side and upper left. See figures 4-21 and 4-22.

(3) Remove the two screws that attach the two larger motor supports to the sides of the evaporator frame.

(4) Remove the four screws and the four lock washers that attach the two larger supports to the motor.

(5) Remove the two screws securing the smaller motor supports to the frame, taking care to support the motor and fan assembly.

(6) Carefully lift the motor and fan assembly out far enough to gain access to the set screw(s) in the fan.

(7) Loosen the set screw(s) and remove the fan.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

b. Cleaning. Wipe the fan blades with a clean cloth dampened slightly with dry cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

c. Inspection. Check the fan for breaks, cracks, dents, loose rivets and bent or otherwise deformed fan blades. Replace the evaporator fan if it is defective.

d. Installation.

(1) Slip the fan onto the motor shaft with the hub facing away from the motor. Aline the screw(s) with the flat surfaces on the motor shaft. Tighten the set screw(s).

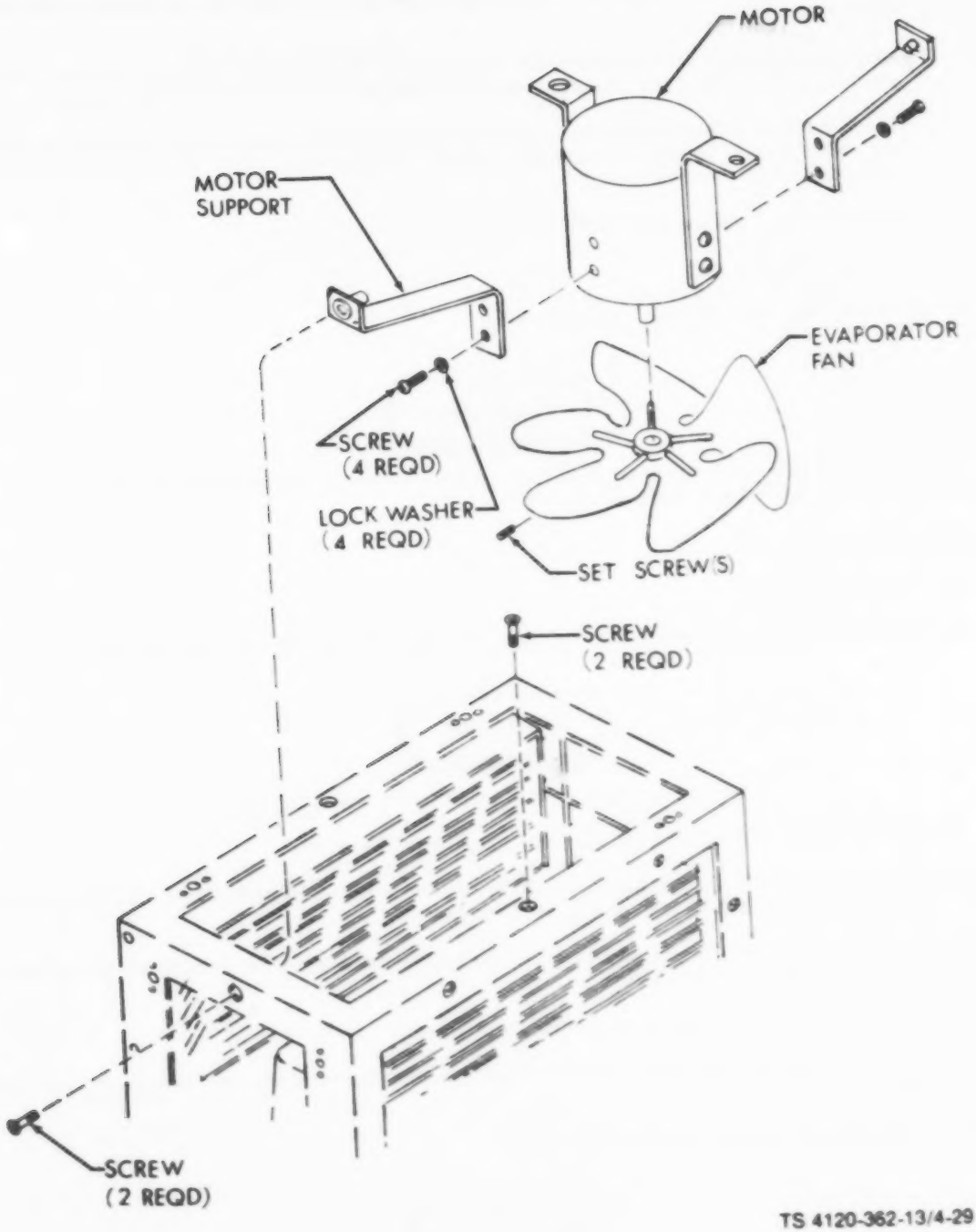

Figure 4-29. Evaporator Fan.

(2) Carefully position the fan and motor assembly in the unit and install the two screws in the smaller motor supports.

(3) Install the two larger motor supports with two screws in the frame and four each of screws and lock washers in the motor. Take care not to strip the threads in the aluminum motor housing.

(4) Check the fan for clearance by spinning the fan by hand. Clearance between the blade tips and the fan shroud should be even. If necessary, loosen the screws that attach the motor supports to the frame and adjust the clearance.

(5) Install the top, right side and upper left panels.

(6) Connect power to unit.

4-39. EVAPORATOR FAN MOTOR (figure 4-30).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Removal.

(1) Disconnect power.

(2) Remove the following panels: top, right side and upper left. See figures 4-21 and 4-22.

WARNING

Discharge capacitor before touching the two terminals.

(3) Tag and disconnect motor leads from the capacitor and the relay.

(4) Remove the two larger motor supports by removing two screws from each side of the frame and four screws and lock washers from each end of the motor.

(5) Remove the two remaining screws attaching the smaller motor supports to the frame, taking care to support the motor and fan assembly.

(6) Carefully lift the motor and fan assembly out of the unit.

(7) Remove the two smaller motor supports from the motor by removing four screws and four lock washers.

(8) Loosen the set screw(s) and remove the fan.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38°C to 59°C).

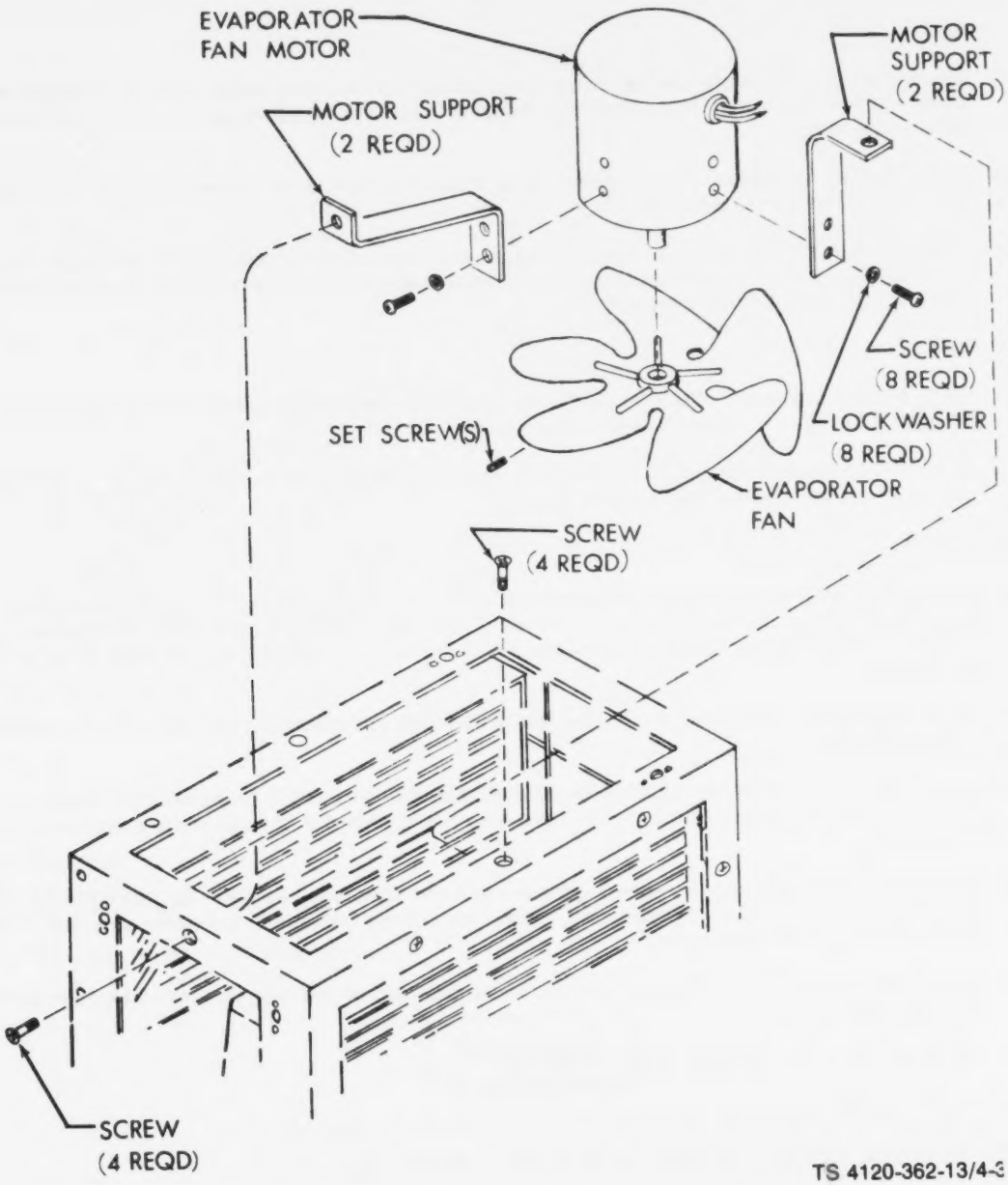

Figure 4-30. Evaporator Fan Motor

b. Cleaning. Wipe the motor and the other disassembled parts with a clean cloth dampened slightly with dry cleaning solvent (Fed Spec P-D-680) and dry thoroughly.

c. Inspection.

(1) Check the motor for dents, cracks, condition of threads in mounting holes, loose or damaged lead wires and free rotation of motor shaft. If a defect is found that could cause the unit to malfunction, replace the motor.

(2) Check the fan for breaks, cracks, dents, loose rivets and bent or otherwise deformed fan blades. Replace the fan if it is defective.

(3) Check the mounting brackets for breaks, cracks, dents and condition of threads in blind nuts. Repair minor damage using conventional sheet metal repair methods. Replace damaged blind nuts or total bracket if damage indicates replacement.

d. Testing.

(1) Using a continuity tester, check for continuity between motor leads. If a lack of continuity is shown, an open winding is indicated. Replace the motor.

(2) Check for continuity between the red lead and the motor frame. If there is continuity, one of the windings is shorted to ground. Replace the motor.

e. Installation.

(1) Install the two smaller motor supports using four each of the screws and lock washers. Take care not to strip the threads in the aluminum motor housing. Slip the fan onto the motor shaft with the hub facing away from the motor. Aline the set screw(s) with the flat surfaces on the motor shaft. Tighten the set screw(s).

(2) Carefully position the fan and motor assembly in the unit and install the two screws in the smaller motor supports.

(3) Install the two larger motor supports by attaching two screws to the frame and four each of the screws and lock washers to the motor. Take care not to strip the threads in the aluminum motor housing.

(4) Check the fan for clearance by spinning the fan by hand. Clearance between the blade tips and the fan shroud should be even. If necessary, loosen the screws that attach the motor supports to the frame and adjust the clearance.

(5) Connect the motor leads to the relay and capacitor. See tags on removed motor and also see wiring diagram, figure 4-7.

(6) Install the top, right side and upper left panels.

(7) Connect power to unit.

4-40. EVAPORATOR FAN MOTOR RUN CAPACITOR (figure 4-31).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

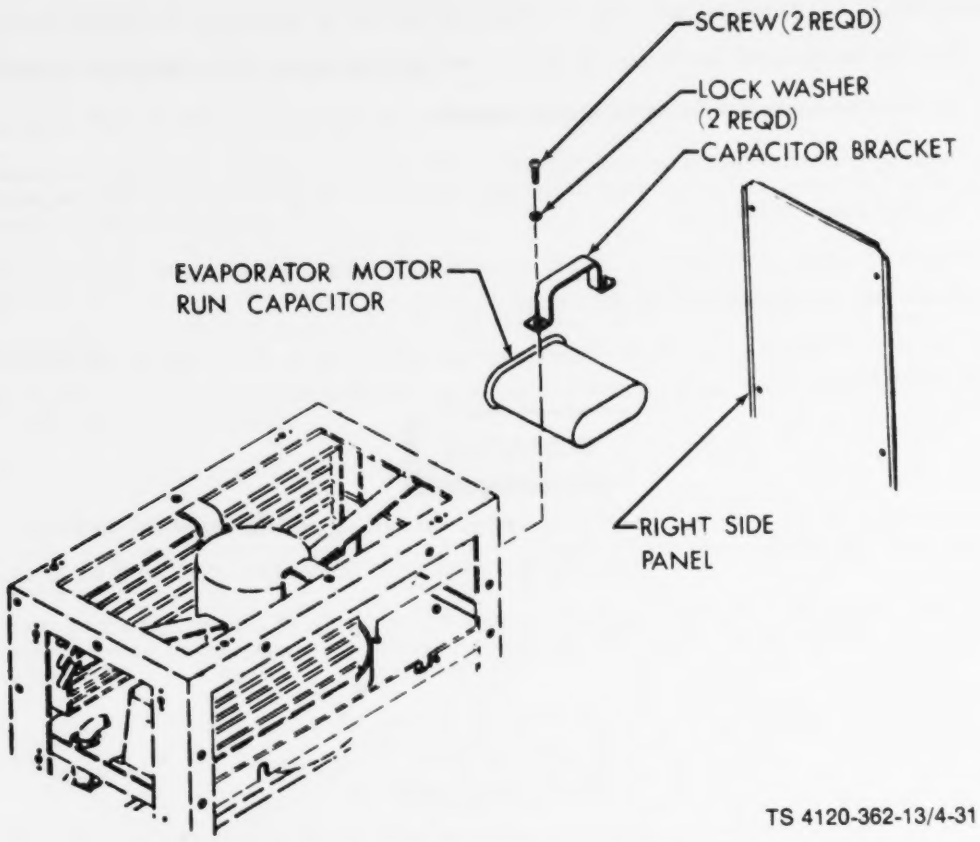

Figure 4-31. Evaporator Fan Motor Run Capacitor.

a. Removal.

(1) Disconnect power.

(2) Remove the right side panel.

WARNING

Discharge capacitor before touching the two terminals.

(3) Tag and disconnect the leads.

(4) Remove two each screws and lock washers and remove the capacitor bracket.

(5) Remove the capacitor.

b. Cleaning. Wipe the capacitor with a clean dry cloth.

c. Testing. Test a suspected defective capacitor with a capacitance tester. Replace if found bad. If a capacitance tester is not available, refer to direct support.

d. Installation.

(1) Position the capacitor and capacitor bracket and attach with two screws and two lock washers.

(2) Connect the leads. See figure 4-7, wiring diagram.

(3) Install the right side panel.

(4) Connect power to the unit.

4-41. POWER RELAY (EVAPORATOR SECTION)

The power relay is capable of switching 10 amperes per min. at 115 V ac. It is mounted on the evaporator fan guard. See figure 4-32.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

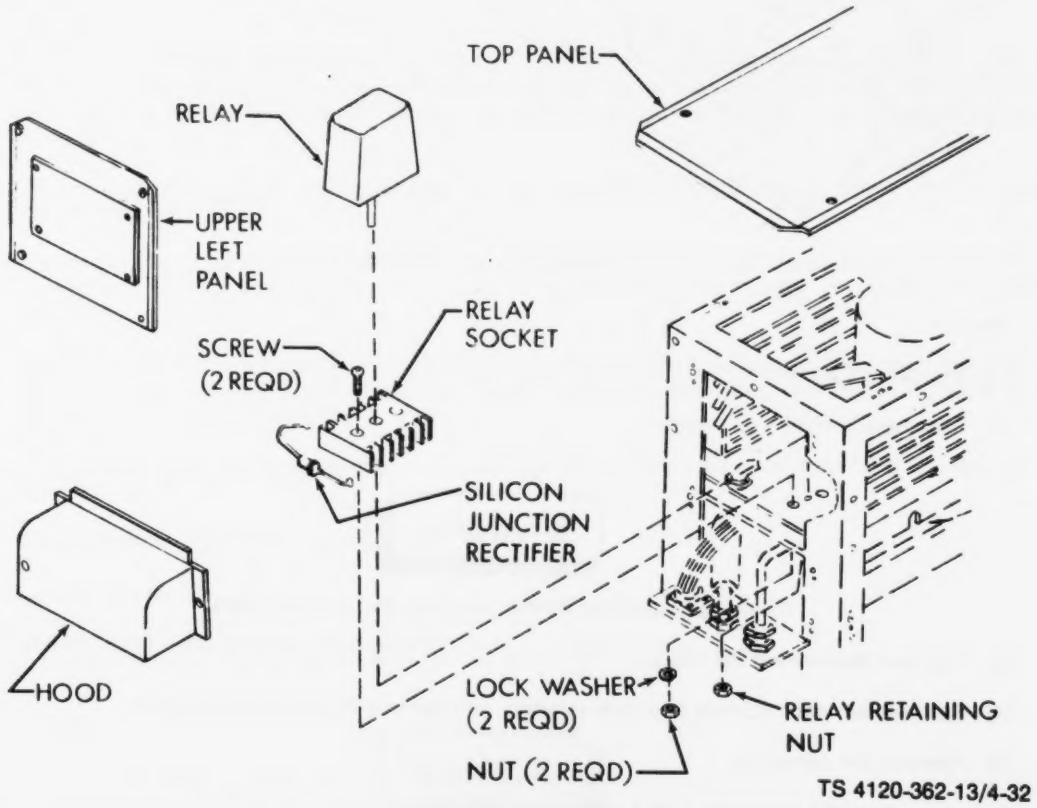

Figure 4-32. Relay and Silicon Junction Rectifier. (Evaporator Section)

a. Access. Disconnect power and remove the top panel and the upper left panel.

b. Cleaning. Wipe parts with a clean dry cloth.

c. Removal. Remove the relay retaining nut and pull the relay up and out of the unit.

d. Inspection. Inspect for cracks, corrosion, loose electrical connections and loose mounting hardware. Repair and tighten loose electrical connections and tighten loose mounting hardware. Replace cracked, broken or badly corroded parts.

e. Testing. Touch the probes of a continuity tester to pins 6 and 7. If a lack of continuity is indicated, replace the relay.

f. Installation.

(1) Carefully aline the relay pins with the relay socket. Press the relay firmly into the socket and secure with relay retaining nut.

(2) Install the hood and the top and upper left panel.

(3) Connect power to the unit.

4-42. SILICON JUNCTION RECTIFIER (EVAPORATOR SECTION)

The CR2 silicon junction rectifier, is wired to pins 6 and 7 of the power relay socket terminals. This rectifier prevents radio frequency interference (RFI) spikes from entering the power circuit. See figure 4-32 and wiring diagram, figure 4-7.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Access. Disconnect power and remove the upper left panel.

b. Testing.

(1) Disconnect one lead of the rectifier from either terminal 6 or terminal 7 of the power relay socket terminals.

(2) Using an ohmmeter, place a probe on each of the rectifier leads and take a reading. There should be a high reading in one direction and a low reading in the other direction. Replace if defective.

c. Installation.

(1) When a silicone junction rectifier must be replaced install heat shrink tubing and terminals on rectifier leads.

(2) Connect the rectifier to terminals 6 and 7 of the relay socket. See wiring diagram figure 4-7 for proper input-output connections.

(3) Install the upper left panel and connect power to unit.

4-43. REFRIGERANT PIPING (EVAPORATOR SECTION) (figure 4-33).

a. Access. Remove the following outside panels: front, right side, lower left, back, and the hood. See figures 4-21 and 4-22.

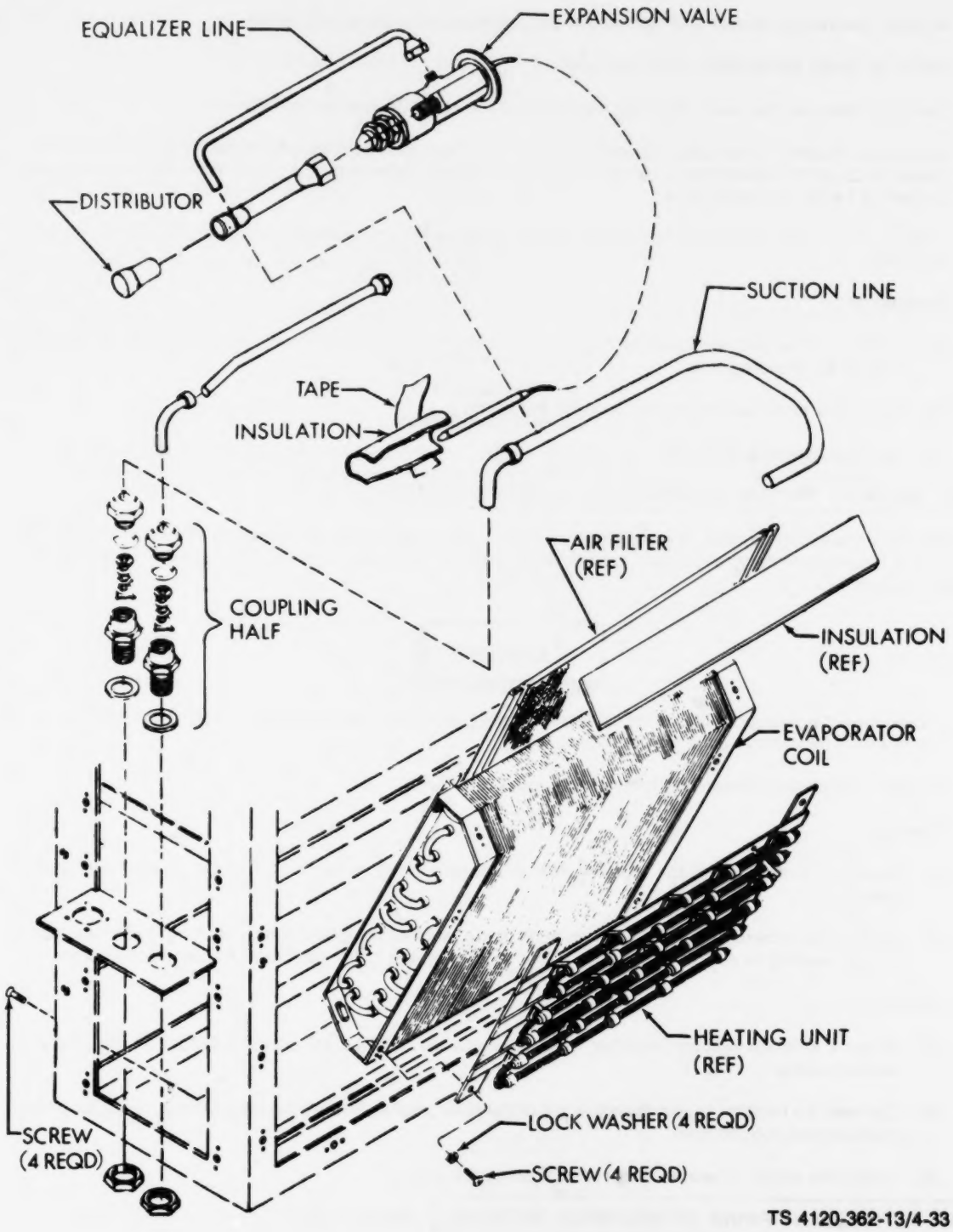

Figure 4-33. Refrigerant Piping, Evaporator Section.

b. Inspection/Test of installed items. Inspect tubing and fittings visually for nicks, cuts, cracks, dents and kinks. If damage appears minor, test for leaks. If no leaks are detected and dents and kinks are not severe enough to limit refrigerant flow, consider the tubing serviceable. If a leak, severe dent or kink is found, report to direct support maintenance for repair or replacement.

c. Testing. Test by one of the following methods.

CAUTION

The electronic leak detector is sensitive to the presence of refrigerant gas in atmosphere. When refrigerant gas is present in the atmosphere of the work area, false indications can result. Use in a well ventilated but draft free area.

(1) Electronic Leak Detector. Turn the electronic unit on, and slowly pass the probe around all points of the refrigerant system at which a leak could exist. Depending upon the type of detector used, a leak will be indicated by an audible signal, a light, or by meter deflections.

(2) Soap Solution. Brush soap solution on all possible points of leakage, and watch for bubbles. Follow a definite sequence to avoid missing any points that should be tested. Wipe the solution from all joints, and mark any point at which a leak is found.

d. Replacement. If test results show any leaks, mark the location and report to direct support maintenance.

4-44. EXPANSION VALVE (EVAPORATOR SECTION) (figure 4-33).

The expansion valve is located in the lower right area of the evaporator section. It controls refrigerant flow to the evaporator coil.

a. Access. Remove the right side and back panels. See figures 4-21 and 4-22.

b. Inspection/Test of installed items.

(1) Inspect for evidence of leaks, kinked or otherwise damaged capillary line, and loose or missing valve stem cap.

(2) Check thermal bulb to see that it is securely clamped to the suction line.

(3) If a leak is suspected or indicated, test per paragraph 4-43c.

c. Replacement. If inspection/test results indicate replacement, refer to direct support maintenance.

d. Replacement. If inspection/test results indicate replacement, refer to direct support maintenance.

e. Install the right side and back panels.

4-45. AIR FILTER (EVAPORATOR SECTION)

The air filter, located in the evaporator section, traps dust, dirt and other airborne debris. See figure 4-34.

a. Removal.

(1) Remove the front panel.

(2) Slide the air filter up and out of the side clips located on the top side of the evaporator coil.

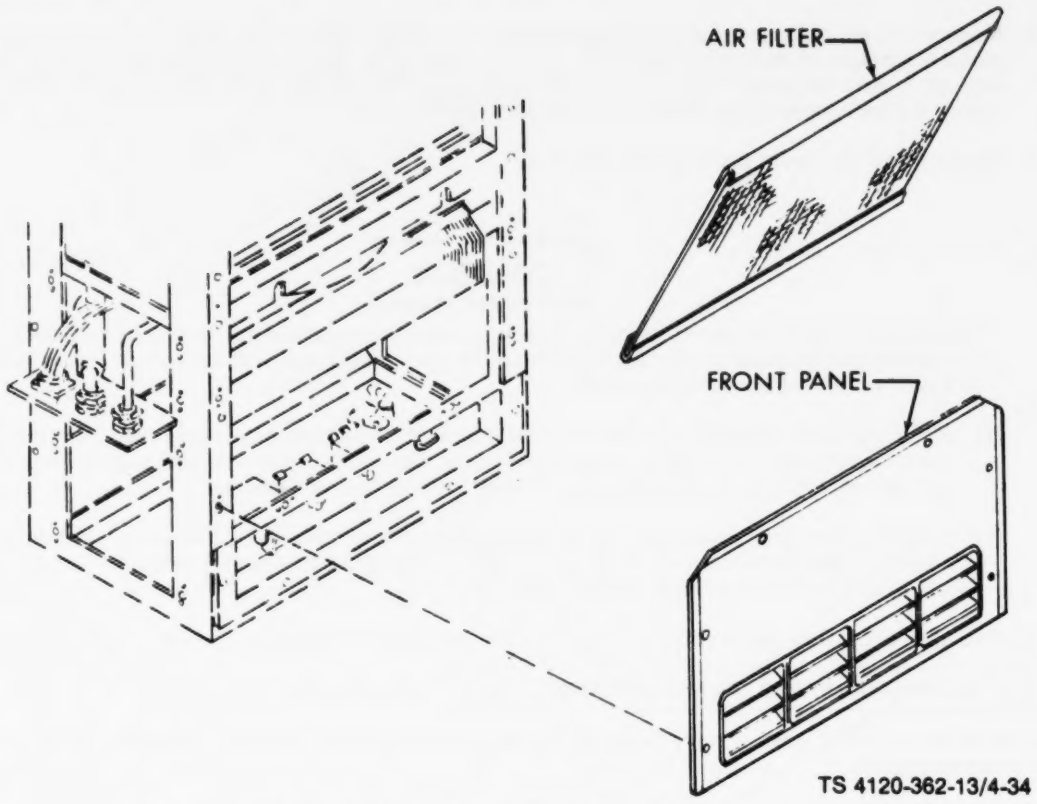

Figure 4-34. Air Filter, Evaporator Section.

WARNING

Dry cleaning solvent (Fed Spec P-D-680) used to clean parts is potentially dangerous to personnel and property. Do not use near open flame or excessive heat. Flash point of solvent is 100°F to 138°F (38° to 59°C).

b. Cleaning. Immerse the filter in detergent solution or dry cleaning solvent (Fed Spec P-D-680). Agitate until dirt is removed, using a soft brush if necessary to loosen caked-on dirt. Rinse in clear water or clean dry cleaning solvent. Allow filter to dry completely.

c. Inspection. Inspect the filter for damage such as perforations or punctures in the screen and aluminum foil maze that could permit passage of unfiltered air. Inspect for areas of packed or crushed maze material that would obstruct airflow through the filter. Check for deformation of the frame, and straighten if possible without crushing maze material. Replace filter if crushed, punctured, badly deformed or broken.

d. Carefully slide the air filter down into the side clips located on the top side of the evaporator coil.

e. Install the front panel.

4-46. HEATING UNIT (EVAPORATOR SECTION) (figure 4-35.)

The heating unit, located in the evaporator section, is an electrical resistance unit that can add heat on demand to the air passing over it.

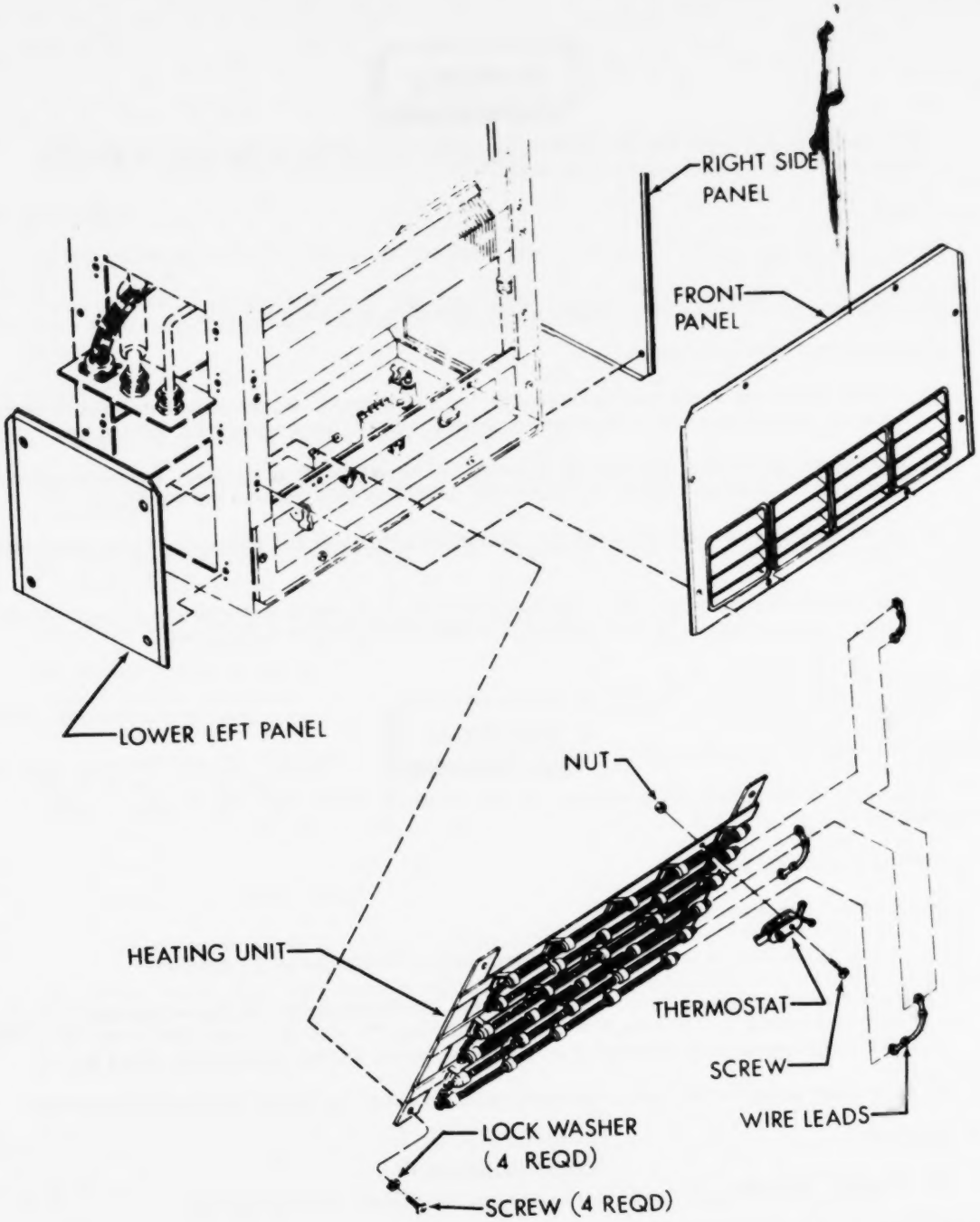

Figure 4-35. Heating Unit, Evaporator Section

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

a. Access.

(1) Disconnect power.

(2) Remove the following outside panels: front, right side, and lower left side.

b. Inspection/Test of installed items.

(1) Inspect the heater coils for broken elements, cracked or broken insulators, excessive corrosion and loose or broken mounting strips. If any of these conditions exist replace the heating unit.

(2) Inspect the heater overtemperature protector thermostat for pitted contacts, excessive corrosion, cracked or broken body parts. If any of these conditions exist, replace the thermostat.

(3) Check the heater and the thermostat for loose or missing hardware. Replace or tighten hardware as indicated.

(4) Use a continuity tester and check heater coil continuity by touching the probes to each end of the heater coil. If continuity is not indicated, it is defective and must be replaced.

WARNING

The power supply must be connected for the following tests. Take the necessary safety precautions.

c. Testing of installed items.

(1) Connect the power supply.

(2) Place switch SW2 in the ON position. Place switch SW3 in the HEAT position.

(3) With a voltmeter, check the voltage to the heater coil terminals and the heater overtemperature protector thermostat for 115 volts, nominal. If the nominal 115 volts is not recorded, check for problems with the power supply, switches or wiring to the heater. See wiring diagram, figure 4-7.

(4) If 115 volt power is recorded at the thermostat but not at the heater, replace the thermostat.

d. Removal.

(1) Disconnect power.

(2) If heaters have been operated, let the unit cool down.

(3) Tag and disconnect electrical leads to heater and thermostat.

(4) Remove four screws and four lock washers and carefully remove the heater and thermostat assembly from the unit.

(5) Remove the screw and nut from the thermostat and remove the thermostat.

CAUTION

After heating elements have been in operation they become very brittle. Extreme care must be taken not to break them during cleaning operation.

e. Cleaning.

Using a clean, dry cloth or a soft brush, carefully clean heater and thermostat.

f. Repair or replacement. Repairs, other than minor repairs of the mounting frame of the heater, are not advised. Should any of the test or inspection results so indicate, the heater or the thermostat should be replaced.

g. Installation.

(1) Install the thermostat using a screw and nut.

(2) Carefully mount the heater assembly to the evaporator coil flanges using four screws and four lock washers.

(3) Connect the electrical leads. Refer to the tags added when wires were removed and the wiring diagram (figure 4-7).

(4) Install the front, right side and lower left side panels.

(5) Connect power to the unit.

4-47. EVAPORATOR COIL

The evaporator coil consists of copper tubing with aluminum fins. It removes heat from the air and transfers it to the refrigerant. See figure 4-33.

a. Access. See figures 4-21 and 4-22 and remove the following panels: front, right side, lower left side and back.

b. Inspection/Test of installed items.

(1) Check for accumulated dirt. Clean if an accumulation of dirt is evident.

(2) Check fins for dents, bent edges or any condition that would block or distort air flow. Straighten all damaged fins with a plastic fin comb.

(3) If a leak is indicated, test per paragraph 4-19c.

WARNING

Compressed air used for cleaning purpose will not exceed 30 PSI.

c. Cleaning. Clean coil with a soft bristled brush, or use compressed air at 30 psi or less from the inside of the coil to blow the dirt out. Take care to avoid fin damage.

d. Repair/Replacement. If inspection/test results indicate repairs or replacement, refer to direct support maintenance.

e. Install the following panels: front, right side, lower left side and back.

4-48. FRAME (EVAPORATOR SECTION)

a. Access. Remove all panels and the hood. See figures 4-21 and 4-22.

b. Inspection/Test of installed items.

(1) Check for missing, loose or damaged hardware. Replace all hardware found missing or defective.

(2) Inspect for dents, bends and cracked or broken welds. Refer defective condition to direct support maintenance.

c. Repair. Refer all repairs other than hardware replacement to direct support maintenance.

d. Install all panels and the hood. See figures 4-21 and 4-22.

Section VI.

PREPARATION FOR STORAGE OR SHIPMENT.

a. See TM740-90-1 for Administrative Storage of Equipment.

CAUTION

Maintain the units in a vertical position at all times.

b. Intermediate. No special handling is required for intermediate storage other than protection from damage and the elements.

c. Long term storage or preparation for shipment by air. When the unit is to be moved a considerable distance, it is advisable to pump down the refrigerant charge into the receiver. Proceed as follows:

(1) Remove cap from refrigerant valve stem located on receiver immediately behind condenser air intake grille.

(2) Turn valve stem clockwise as far as it will go.

(3) Turn SW4 to coldest setting and set SW3 to COOL.

(4) Turn SW2 to ON and observe sight glass. Bubbles will soon appear. Continue operating compressor until bubbling diminishes and almost disappears. A slight amount of colorless liquid refrigerant will be noticed as well as a little oil. Just before bubbling and liquid refrigerant disappears entirely, turn SW2 to OFF to shut off unit.

(5) Disconnect the power supply cable.

(6) Remove the interconnecting cable and refrigerant hoses.

(7) Remove the floor or wall mounting hardware and drain connections.

(8) Crate the unit, utilizing base mounting bolts, to secure sections to base of crate or skid.

(9) Pack hoses and cables in crates with unit to avoid loss.

(10) Fill voids in crate with shock absorbing material. Do not use material that may clog condenser and evaporator coils.

(11) Include warning tag with shipment indicating necessity for opening receiver valve prior to operation of the unit.

CHAPTER 5

DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

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Section I.

GENERAL INFORMATION.

5-1. TOOLS AND LISTS

a. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

b. No special tools are required for maintenance of the equipment. Test, maintenance and diagnostic equipment (TMDE) and support equipment include standard pressure and vacuum gages, vacuum pump and charging manifolds found as standard equipment in any refrigeration shop.

c. Repair parts are listed and illustrated in the Repair Parts and Special Tools (RPSTL) list TM 5-4120-362-23P covering organizational and direct support maintenance for this equipment.

Section II.

MAINTENANCE PROCEDURES.

5-2. REFRIGERANT HOSES

If inspection/test results shown in paragraph 4-9a indicate replacement of the refrigerant hoses, replace either or both as indicated per the following instructions.

a. Removal. See figure 4-6.

(1) It is normally not necessary to discharge the refrigerant to replace the hoses. Both the fittings on the unit and the fittings on the hose ends are equipped with poppet valves that close when the hoses are disconnected.

(2) Remove the hood and upper panel above the hood from both sections.

CAUTION

Do not allow the fitting on the unit to turn.

(3) Use two wrenches, one to hold the hex portion of the half coupling body located directly above the mounting angle on the unit, the other to loosen the hose assembly end from the unit. If the hose is to be reused, do not allow it to kink or twist.

b. Installation.

(1) Use two wrenches, one to hold the hex portion of the half coupling body located directly above the mounting flange on the unit, the other to tighten the hose assembly end to approximately 35 foot pounds (47.8 newton meters) of torque.

CAUTION

Do not allow the fitting on the unit to turn. Avoid kinking or twisting the hose.

(2) Install the hoods and upper panels on both sections.

5-3. REFRIGERATION COMPONENT AND SYSTEM REPAIR GENERAL

The following instructions will apply to most all refrigeration item repair and replacement procedures. See Individual component listings for step-by-step removal and replacement instructions.

a. Releasing the refrigerant charge.

WARNING

DANGEROUS CHEMICAL

is used in this equipment

DEATH

or severe damage may result if personnel fail to observe safety precautions. Use great care to avoid contact with liquid refrigerant or refrigerant gas being discharged under pressure. Sudden and irreversible tissue damage can result from freezing. Wear thermal protective gloves and a face protector or goggles in any situation where skin or eye contact is possible.

Prevent contact of refrigerant gas with flame or hot surfaces. Heat causes the refrigerant to break down and form carbonyl chloride (phosgene), a highly toxic and corrosive gas.

(1) Remove the intake air grille from the condenser section. See figure 4-8.

(2) Remove valve cap from receiver valve stem.

(3) Back seat the receiver valve by turning the valve stem counterclockwise until it stops.

(4) Remove flare cap from the receiver valve.

(5) Rotate valve stem clockwise slowly until gas starts to escape.

NOTE

Do not permit the oil to escape from the unit. If oil is escaping, close the valve slightly.

Do not permit the refrigerant to escape fast enough to form ice or frost on either the lines or the valve.

b. Leak Test of an uncharged system.

(1) Remove the valve cap from the receiver valve stem.

(2) Turn valve stem counterclockwise until it stops.

(3) Remove flare cap from the receiver valve.

(4) Connect refrigerant R-12 source to gage valve port. Turn valve clockwise one turn. Allow refrigerant to build up pressure to 50 psig. (3.52 kgm/cm^2).

(5) Turn valve stem counterclockwise until it stops. Disconnect refrigerant line and connect line from a regulated dry nitrogen source to the removable frame angle.

(6) Remove the two screws and lock washers holding the valve to the bracket.

c. Installation (figure 4-16).

(1) Assemble the service valve to the bracket with two each screws and lock washers.

(2) Install the valve and bracket assembly to the removable frame angle with two each screws and lock nuts.

(3) Connect and tighten the flare nuts connecting the tubing to the service valve.

(4) Leak test the valve and newly connected tubing in the area of the valve in accordance with paragraph 5-3b.

(5) Evacuate the system in accordance with paragraph 5-3c.

(6) Charge the system in accordance with paragraph 5-3d.

(7) Install the rear panel.

(8) Connect power to the unit.

Turn valve stem one turn clockwise and allow nitrogen to build up to 300 psig. Turn valve stem counterclockwise until it stops.

(9) Test for leaks using one or both of the following methods:

CAUTION

The electronic leak detector is sensitive to the presence of refrigerant gas in the atmosphere. When the refrigerant gas is present in the atmosphere of the work area, false indications can result. Use in a well ventilated but draft free area.

(a) Electronic Leak Detector. Turn the electronic unit on, and slowly pass the probe around all points of the refrigeration system at which a leak could exist. Depending upon the type of detector used, a leak will be indicated by an audible signal, a light or by a meter deflections.

(b) Soap Solution. Brush soap solution on all possible points of leakage and watch for bubbles. Follow a definite sequence to avoid missing any points that should be tested. Wipe the solution from all joints, and mark any joint at which a leak is found.

(10) Release the test charge.

d. Evacuating the system.

(1) If the intake grille on the condenser section is in place, remove it. (figure 4-8).

(2) Remove receiver valve stem cap.

(3) Remove gage port cap from receiver valve.

(4) Connect refrigerant compound gage to the gage port of valve with charging hose.

(5) Connect the second hose of refrigerant gage manifold to suction side of vacuum pump.

(6) Open charging valve on receiver; then start vacuum pump. Open valve on gage manifold.

(7) Evacuate system for 30 minutes. Gage indication should be at least 28 inches of mercury.

(8) Close valve on compound gage manifold. Stop vacuum pump and remove hose.

(9) Connect hose for R-12 drum and open drum valve. Loosen hose fitting on gage manifold and allow R-12 vapor to sweep thru hose.

(10) Tighten hose fitting on manifold, open manifold valve. Open receiver valve and admit R-12 vapor into system until gage reads 15 pounds (1.1 kgm/cm^2) positive pressure.

(11) Close drum valve and manifold valve and reconnect hose to vacuum pump. Start pump, open manifold valve and evacuate for 30 minutes. Repeat steps 6 thru 10 three times. On final evacuation, run vacuum pump for one hour.

NOTE

Check bullseye in sight glass after final evacuation. Color should be pure green. If there is a tint of yellow, repeat steps 6 thru 10 until color is pure green.

NOTE

Allow unit to remain on vacuum for 15 minutes. If vacuum holds, system is ready for charging. If vacuum does not hold, check for leaks in system.

e. Charging the system.

(1) Evacuate the system. Refer to paragraph 5-30c.

(2) Bleed the charging equipment as follows:

(a) Connect metered refrigerant charging bottle to drum of R-12.

(b) Connect outlet of charging bottle to gage manifold by means of the charging hose.

(c) Open refrigerant drum valve.

(d) Open fitting on inlet to metered bottle and allow vapor to sweep through line.

(e) Tighten fitting on inlet to metered bottle and open inlet valve slightly.

(f) Open vent valve on charging bottle and allow R-12 vapor to sweep through bottle.

(g) Close vent, close inlet valve. Open outlet valve and loosen hose fitting on gage manifold.

(h) Open inlet valve to metered bottle and allow R-12 vapor to sweep through inlet hose battle and outlet hose to gage manifold.

(i) Tighten hose connections to manifold valve, shut outlet valve from metered bottle.

(j) Invert R-12 drum and feed 2.5 lbs. of liquid refrigerant into metered bottle (opening the vent valve very slightly will facilitate this process).

(k) Close inlet valve to metered bottle and valve vent.

NOTE

Make sure that the bottle contains 2.5 lbs. of refrigerant. If necessary, place slightly more than 2.5 lbs. in bottle and bleed off excess through vent.

(l) When charging direct from a drum of refrigerant, first weigh the drum and observe the weight during the charging operation taking care to stop when 2.5 lbs. of refrigerant has been used.

(3) Charge the system as follows:

(a) Remove cap, turn suction valve stem clockwise until it stops and connect hose from manifold suction gage.

(b) Connect hose from manifold discharge gage and purge air from both the suction and discharge gage hoses. Open metered bottle outlet valve, manifold valve to the discharge gage and receiver valve to allow refrigerant to enter system 1.5 lbs will enter readily.

(c) To charge remainder of refrigerant into system, front seat (clockwise) receiver valve and close discharge gage manifold valve. Operate compressor until discharge gage indicates 5 psig. Open gage manifold valve. Remainder of refrigerant should flow into system. If not, shut off manifold valve and operate compressor until gage indicates 5 psig. Stop compressor and open manifold valve. Repeat as often as necessary to charge entire 2.5 lbs into system.

CAUTION

Do not charge liquid refrigerant into the suction service valve. Damage to the unit will result.

(4) Backseat the receiver valve. Close all valves in charging system and remove hose fitting from receiver valve. Replace stem cap and gage port cap.

f. Brazing/Debrazing techniques.

(1) The refrigeration system must be completely discharged before removing any part of the system. If debrazing is required for removal, a flow of oil pumped dry nitrogen must be introduced through the system before the joint is heated to brazing temperature. Any refrigerant gas, air or moisture in the system would cause serious corrosion at brazing or debrazing temperature.

(2) Heating. Sufficient heat should be applied uniformly around the joint to reach the melting point of the filler metal as quickly as possible. Slow or non-uniform heating permits heat to be conducted away from the joint, sometimes melting an adjacent joint at the same time as the one intended.

(3) Cleaning. Residual filler metal can be removed from a debrazed tube in the following manner.

WARNING

Wear welders' gloves or other thermal protective gloves when performing the following operation.

(a) Fold a piece of fiberglass cloth about 6 x 6 inches and wrap it loosely around the tubing, a few inches away from the tubing end to be cleaned.

(b) Heat the tubing at the end to be cleaned until the braze filler metal is thoroughly melted.

(c) Grasp the fiberglass wrapping firmly, and pull it over the tubing end with a twisting motion.

(4) Protection from heat.

WARNING

Polyurethane foam insulation breaks down to form toxic gases when heated to brazing temperature.

(a) When brazing/debrazing refrigerant tubing or fittings near an insulated wall of the air conditioner, use a nonheat conductive shield to deflect the flame of the torch away from the insulation. Perform the operation in a well ventilated area.

(b) When brazing/debrazing tubing from expansion valves, solenoid valves or other components that could be warped or damaged by brazing temperature, the component should be disassembled to the extent possible, and the body alone brazed/debrazed. If disassembly is impractical or impossible, the entire component, except for the joints to be heated, should be wrapped in wet cloth to act as a heat sink.

(5) Types of filler alloy (solder).

(a) Phos-copper. The entire joint area must be as clean as possible. If tubing must be cut to make a repair, the cut end must be reamed both inside and out.

CAUTION

Use extreme care to prevent contamination of refrigerant system with dirt, moisture, metal chips, flux or other foreign particles.

Parts to be joined should be close fitted, approximately 0.003 inch clearance. Copper to copper joints will require no flux, but all other metals will require the use of an approved flux. The joint being brazed should be heated evenly to 1300 degrees Fahrenheit. The rod starts to flow at 1300 degrees Fahrenheit. The flame should be kept moving, covering as much of the joint as possible. When the flux turns clear or when the metal turns to a dull red color, the flame should be drawn

back two to three inches and the rod applied. Move the flame completely around the joint to cause the rod to flow evenly into the joint. Avoid overheating and remelting. To remove surplus flux, wipe with a cloth saturated with hot water.

When making joints in areas close to the sight glass, valves or hose fittings, a heat sink must be provided to prevent the transfer of heat into areas which may be damaged by extremely high temperatures.

If care is used to prevent moisture from entering the system, such a heat sink may be made from a cloth soaked in water and wrapped around the temperature sensitive part.

(b) Silver Brazing Alloys. Although the phos-copper joints are acceptable in most instances, a more dependable joint can be made with silver brazing alloy with a high silver content. It is especially recommended to joint dissimilar metals and for use in joints subject to vibration. Clean all joints thoroughly of all oxides, dirt and grease. Maintain 0.009 inch maximum clearance between tube and fitting. Cover the joint surfaces with an approved flux before brazing.

CAUTION

Be careful not to allow the flux to contaminate the system.

Heat the joint uniformly with neutral flame and broad heat until the flux is liquid. Apply the rod to the joint and keep flame moving. Excess flux may be removed by wiping with a cloth saturated in hot water.

5-4. PRESSURE SWITCH (CONDENSER SECTION)

See paragraph 4-17 for operational check, inspection and cleaning instructions.

a. Replacement. (figure 4-14).

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the top, upper right and rear panels.

(3) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(4) Debraze the end of the capillary line from the tee in accordance with instructions in paragraph 5-3e.

(5) Tag and disconnect wire leads.

(6) Remove the two screws holding the bracket to the frame and remove the pressure switch and bracket from the unit.

(7) Remove the two screws and lock washers holding the bracket to the switch.

b. Installation. See figure 4-14.

(1) Assemble the pressure switch to the bracket with two screws and lock washers.

(2) Install the switch and bracket assembly on the frame angle with two screws.

(3) Carefully form the capillary tubing so that the open end is fitted into the tee on the vertical tubing from which the old capillary was removed. Coil the slack capillary tubing into a 3 inch (7.62 cm) diameter or larger coil and tape to a nearby tube or other rigid support.

(4) Braze the end of the capillary into the tee in accordance with instructions in paragraph 5-3e.

(5) Connect the wire leads. See figure 4-7, wiring diagram.

(6) Leak test the refrigeration piping in the area of the newly brazed joint in accordance with paragraph 5-3b.

(7) Evacuate the system in accordance with paragraph 5-3c.

(8) Charge the system in accordance with paragraph 5-3d.

(9) Install the top, upper right and rear panels.

(10) Connect power to the unit.

5-5. REFRIGERANT PIPING (BOTH SECTIONS)

For access, inspection of installed items, and testing, see paragraph 4-19 for condenser section piping and paragraph 4-43 for evaporator section piping.

a. Repair/Replacement.

WARNING

Disconnect power from the air conditioner before performing maintenance on internal components. The voltage used can be lethal.

(1) Disconnect power.

(2) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(3) Debraze the leaking or damaged joints in accordance with instructions in paragraph 5-3e.

(4) If a fitting or section of tubing is defective, replace it.

(5) Braze the tubing or fitting connections in accordance with instructions in paragraph 5-3e.

(6) Leak test the refrigeration piping in the area of newly brazed joints in accordance with paragraph 5-3b.

(7) Evacuate the system in accordance with paragraph 5-3c.

(8) Charge the system in accordance with paragraph 5-3d.

(9) Install outside panels.

(10) Connect power to the unit.

5-6. SERVICE VALVE (CONDENSER SECTION)

See paragraph 4-20 for inspection/test of installed items.

a. Replacement (figure 4-16).

WARNING

Disconnect power from the air conditioner before performing maintenance on internal components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the rear panel.

(3) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(4) Loosen the flare nuts connecting the tubing to the service valve.

(5) Remove the two screws and lock nuts holding the valve bracket.

5-7. HALF COUPLINGS (BOTH SECTIONS)

See paragraph 4-21 for inspection of installed items.

a. Repair or Replacement. See figure 5-1. All repairs other than tightening of screw joints will require disassembly and replacement of some parts. When the half couplings are disassembled for any reason, the O-rings and gaskets should be replaced.

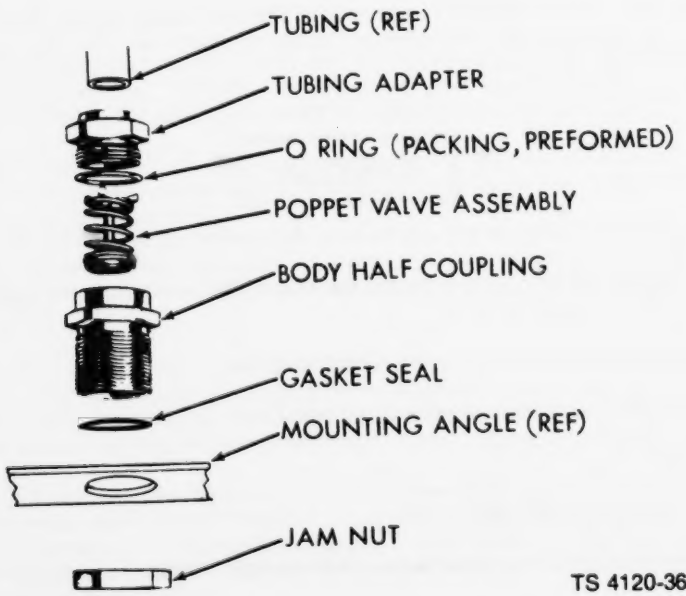

Figure 5-1. Typical Half Coupling

(1) Remove the hood.

(2) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(3) Remove the hose. Use two wrenches to avoid damage to the tubing connections. Use one wrench to hold the hex portion of the half coupling body located directly above the mounting angle on the unit and the other to loosen the hose assembly end. Take care to avoid kinking and excessive twisting of the hose.

(4) Use two wrenches. Using one wrench to hold the valve body, remove the jamnut.

(5) Use two wrenches. Using one wrench to hold the tubing adapter, carefully remove the valve body. Carefully spring tubing up enough to remove the half coupling body, the poppet valve assembly and the O-ring.

(6) Inspect the tubing adapter for cracks and damaged threads. If defective, debraze the tubing adapter in accordance with instructions in paragraph 5-3e.

b. Installation. See figure 5-1.

(1) If the tubing adapter was removed, braze a new one in place in accordance with instructions in paragraph 5-3e.

(2) Slip the poppet valve assembly and O-ring into place in the half coupling body. Carefully engage the threads of the half coupling body and the tubing adapter.

(3) Use two wrenches. Use one wrench to hold the tubing adapter and the other to tighten the half coupling body to approximately 35 foot pounds (47.8 newton meters) of torque.

(4) Carefully slip the threaded portion of the half coupling body through the hole in the mounting angle. Hold the hex on the half coupling body in place with a wrench and tighten the jam nut.

(5) Use two wrenches, one to hold the hex portion of the half coupling body located directly above the mounting flange on the unit, and the other to tighten the hose assembly end to approximately 35 foot pounds (47.8 newton meters) of torque.

CAUTION

Do not allow the fitting on the unit to turn. Avoid kinking or twisting the hose.

(6) Leak test the refrigerant fittings and hose in the area of the newly installed half coupling and hose in accordance with paragraph 5-3b.

(7) Evacuate the system in accordance with paragraph 5-3c.

(8) Charge the system in accordance with paragraph 5-3d.

(9) Install the hood.

5-8. COMPRESSOR (CONDENSER SECTION)

See paragraph 4-22 for inspection of installed items, cleaning and testing.

a. Replacement. See figure 4-16.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the intake air grille, the left side panel, the rear panel and the bottom grille. See figures 4-8 and 4-9.

(3) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(4) Tag and disconnect the wire leads.

(5) Debraze the suction and discharge lines from the compressor in accordance with instructions in paragraph 5-3e.

(6) Remove the hex head cap screw and lock washer that holds the top of the compressor to the removable frame angle.

(7) Remove the two flat head screws that hold the removable frame angle to the frame and carefully pull the removable angle up slightly to free the top of the compressor.

(8) Set the condenser section up on blocks or carefully sling so that the screws holding the mounting feet of the compressor are accessible.

(9) Remove the four flat head screws, lock washers and nuts from the mounting feet of the compressor.

(10) Carefully remove the compressor from the unit.

b. Check the compressor for indications of compressor motor burnout.

(1) Burnout of a compressor motor is indicated by lack of continuity of the motor windings and the condition of compressor oil, which must be determined after the compressor has been removed from the refrigeration system. Causes of compressor motor burnout include the following:

(a) Low line voltage, which causes motor windings to overheat. Before burning out completely, the overheated windings cause chemical breakdown of the refrigerant and the oil to form sludge and other system contaminants.

(b) Loss of refrigerant. An inadequate charge of refrigerant gas in the system reduces the amount of cooling gas within the compressor, resulting in gradual overheating of the motor and failure of the winding.

(c) High head pressure. High head pressures can be caused by clogged or dirty condenser coils or screens, or by an inoperative condenser fan. High head pressure requires the compressor to work harder, creating additional heat which ultimately can result in motor burnout. Poor ventilation around the condenser, and extremely high ambient temperatures can also cause motor failures.

(d) Moisture in system. Leakage of air into the refrigeration system starts a chain reaction which can result in motor burnout. Air contains oxygen and moisture which combined with refrigerant gas form hydrochloric and hydrofluoric acids. These combined with compressor oil form an acid sludge which is carried throughout the system, and which attacks the motor windings, causing short circuits and burnout.

(2) It is important to diagnose the type of compressor motor failure for two reasons. Simple failure, without motor burnout, does not require the extensive cleaning of the entire refrigeration system that bur-

nout requires. Also, motor burnout indicates other problems that have contributed to the failure, and these problems must be corrected or avoided to prevent repetition of the burnout. After removal of a bad compressor from the refrigeration system, remove all external tubing and tip the compressor toward the discharge port to drain a small quantity of oil into a clear glass container. If the oil is clean and clear, and does not have an acrid smell, the compressor did not fail because of motor burnout. If the oil is black, contains sludge and has an acrid odor, the compressor failed because of motor burnout, and the refrigeration system must be cleaned to prevent residual contaminants from causing repeated burnouts when the compressor is replaced.

c. Cleanup procedure after a compressor motor burnout.

(1) You must clean the entire refrigeration system after a burnout has occurred, since contaminants will have been carried to many corners and restrictions in the piping and fittings. These contaminants will soon mix with new refrigerant gas and compressor oil to cause repeated burnouts. To clean the system thoroughly, act as follows:

(2) Remove the filter-drier, and blow down each leg of the refrigeration system. To do this, connect a cylinder of dry nitrogen to each filter-drier connection, in turn, and open the cylinder shutoff valve for at least 30 seconds at 50 psig (3.5 kg/cm^2) pressure.

(3) Connect the two filter-drier fittings with a jumper locally manufactured from refrigerant tubing and fittings.

(4) Disassemble the expansion valve and temporarily remove the valve cage. Reinstall shell of power assembly, using a locally manufactured gasket between power assembly and body to prevent leakage. Tag and retain the valve cage for use at reassembly.

(5) Connect the discharge line of the refrigerant system to the discharge side of a small diaphragm-type pump.

(6) Connect a line containing a filter to the suction line in the unit.

NOTE

An unused filter-drier or other suitable medium may be used as the filter.

(7) The other end of the temporary suction line should be connected to a small drum or suitable reservoir.

(8) A line should be run from the bottom of the reservoir to the inlet of the pump.

WARNING

Be sure there is adequate ventilation during this procedure.

(9) Fill reservoir with fluorocarbon refrigerant, R-11, and start the pump. Continue filling the reservoir with refrigerant, R-11, until it begins to pour out of the return line. Continue flushing for at least 15 minutes.

(10) Reverse the pump connections, replace the filter with a new filtering medium, and backflush the system for an additional 15 minutes.

(11) Remove the pump, reservoir, filter and filter-drier jumper. Place an empty container below the compressor connections, and connect a cylinder of dry nitrogen to each filter-drier connection in turn. Blow down each leg of the system at 50 psig (3.5 kg/cm^2) for at least 30 seconds.

(12) Disassemble the expansion valve and reinstall the valve cage. Install new gaskets and assemble the valve.

(13) Disconnect the dry nitrogen cylinder an immediately install a new filter-drier, making sure that the direction-of-flow arrow points toward the sight glass. Cap or plug compressor connections if compressor is not to be installed immediately.

d. Installation. See figure 4-16.

(1) Carefully place the compressor in the unit and mount to the frame using four each flat head screws, lock washers and nuts.

(2) Move the removable frame angle down and install the two flathead screws that attach the ends of the angle.

(3) Attach the top mounting point of the compressor to the removable angle using a hex head cap screw and lock washer.

(4) Braze the suction and discharge lines to the compressor in accordance with instructions in paragraph 5-3e.

(5) Connect the wire leads. See figure 4-7, wiring diagram.

(6) Leak test the refrigeration piping in the area of the newly brazed joint in accordance with paragraph 5-3b.

(7) Evacuate the system in accordance with paragraph 5-3c.

(8) Charge the system in accordance with paragraph 5-3d.

(9) Install the intake air grille, left side panel, rear panel and the bottom grille.

(10) Connect power to the unit.

5-9. SIGHT GLASS (CONDENSER SECTION)

See paragraph 4-27 for inspection/test of installed items.

a. Replacement (figure 4-16).

(1) Remove the intake air grille. See figure 4-8.

(2) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(3) Loosen the flare nuts connecting the tubing and filter-drier to the sight glass and remove the sight glass.

b. Installation. See figure 4-16.

(1) Connect and tighten the flare nuts to the sight glass

(2) Leak test the valve and newly connected tubing in the area of the valve in accordance with paragraph 5-3b.

(3) Evacuate the system in accordance with paragraph 5-3c.

(4) Charge the system in accordance with paragraph 5-3d.

(5) Install the intake air grille.

5-10. FILTER-DRIER (DEHYDRATOR) CONDENSER SECTION)

The filter-drier assembly is a metal container which contains dehydrating and filtering media through which the liquid refrigerant must flow. A new filter-drier must be installed in the refrigerant system whenever the system has been opened. See figure 4-16.

a. Replacement.

(1) Remove the intake air grille. See figure 4-8.

(2) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(3) Remove the screw, clamp and lock nut that support the filter-drier.

(4) Loosen the flare nuts connecting the tubing and the sight glass to the filter-drier. Remove the filter-drier from the unit.

b. Installation. See figure 4-16.

(1) Connect and tighten the flare nuts to the filter-drier.

(2) Install the clamp that supports the filter-drier with a screw and lock nut.

(3) Leak test the valve and newly connected tubing in the area of the valve in accordance with paragraph 5-3b.

(4) Evacuate the system in accordance with paragraph 5-3c.

(5) Charge the system in accordance with paragraph 5-3d.

(6) Install the intake air grille.

5-11. RECEIVER (CONDENSER SECTION)

See paragraph 4-28 for inspection/ test of installed items.

a. Repair or Replacement. See figure 4-16.

(1) Remove the intake air grille and the bottom grille. See figures 4-8 and 4-9.

(2) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(3) Remove and examine the fusible plug located in the end of the receiver. If this plug is blown, replace it with a part number P580-STL (78857) or equal fusible plug.

(4) Examine the receiver. If there is no other damage, skip steps a-4 thru b-4. If the receiver is damaged, continue with step 5.

(5) Debraze the inlet and outlet tubes to the receiver in accordance with instructions in paragraph 5-3e.

(6) Remove the four flat-head screws and the two receiver mounting brackets.

(7) Carefully slip the receiver out of the unit.

b. Installation. See figure 4-16.

(1) Position the receiver in the unit so that valve and tube connections match existing piping.

(2) Clamp receiver in place using the two receiver mounting brackets and four flat head screws.

(3) Fit the tubing to the inlet and outlet connections of the receiver and braze the joints in accordance with instructions in paragraph 5-3e.

(4) Leak test the refrigeration piping in the area of the newly brazed joints in accordance with paragraph 5-3b.

(5) Evacuate the system in accordance with paragraph 5-3c.

(6) Charge the system in accordance with paragraph 5-3d.

(7) Install the intake air grille and the bottom grille. See figures 4-8 and 4-9.

5-12. CONDENSER COIL

See paragraph 4-29 for inspection/test of installed items and cleaning.

a. Repair or replacement. See figure 4-16. If the inspection/test results indicate only a leak in a return bend or tube connection, perform only those steps necessary to repair the defect and skip to step b-3 and perform the remaining steps that are necessary.

WARNING

Disconnect power from the air conditioner before performing maintenance on internal components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the following grilles and panels: discharge air grille, right upper louvered panel, left louvered panel and the rear panel.

(3) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(4) Tag and disconnect all electrical leads to the motor and items mounted on the condenser fan shroud.

(5) Remove the four screws that attach the motor mounting brackets to the frame. Remove the motor and fan assembly from the unit.

(6) Remove two flat head screws and carefully pull the pressure switch and bracket assembly up and out of the way of the work area.

(7) Remove eight each screws and lock washers and carefully remove the fan shroud.

(8) Debraze the inlet and outlet tubes to the condenser in accordance with instructions in paragraph 5-3e.

(9) Remove six flat head screws and carefully remove the condenser coil from the unit.

b. Installation. See figure 4-16.

(1) Carefully position the condenser coil in the unit and attach it to the frame with six flat head screws.

(2) Fit the tubing to the inlet and outlet connections on the condenser coil and braze the joints in accordance with instructions in paragraph 5-3e.

(3) Leak test the refrigeration piping in the area of the newly brazed joints in accordance with paragraph 5-3b.

(4) Evacuate the system in accordance with paragraph 5-3c.

(5) Charge the system in accordance with paragraph 5-3d.

(6) Carefully position the condenser fan shroud on the coil flange and attach it with eight each screws and lock washers.

(7) Install the fan and motor assembly with four flat head screws. Check the fan for clearance by spinning the fan by hand. Clearance between the blade tips and fan shroud should be even. If necessary, loosen the screws and adjust.

(8) Install the pressure switch and bracket assembly with two flat head screws.

(9) Connect the electrical leads that were disconnected from the motor and items mounted on the condenser fan shroud. See tags on removed electrical leads and see wiring diagram, figure 4-7.

(10) Install the following grilles and panels: discharge air grille, right upper louvered panel, left louvered panel and the rear panel.

(11) Connect power to the unit.

5-13. EXPANSION VALVE (EVAPORATOR SECTION)

See paragraph 4-17 for inspection/test of installed items.

a. Adjustment. The expansion valve, as supplied with the unit, is preset at the factory. This valve should not be adjusted unnecessarily. When adjustment is necessary, see the following instructions:

(1) Remove insulation from a spot on the suction line near the sensing bulb of the thermal expansion valve to be adjusted.

(2) Install an accurate thermometer or the probe of a thermocouple on the bare spot, using a small amount of the thermal mastic, if available, to improve conductivity. Tape the thermometer bulb or thermocouple junction in position, and cover with insulating material.

(3) Remove the left louvered panel from condenser section. See figure 4-9.

(4) Connect a suitable pressure gage to the service valve and open the valve. See figure 4-16.

(5) Operate the air conditioner in the cooling mode for about 30 minutes, observing the thermometer or thermocouple dial to see that the temperature has stabilized. When the temperature remains unchanged for at least two minutes, record the temperature and pressure.

(6) Compare the recorded temperature and pressure with those in Table 5-1. The temperature measured should register approximately 5°F (2.8°C) higher than the temperature listed on the Table.

(7) If adjustment is necessary, remove the cap from the expansion valve and turn the adjusting stem counterclockwise to decrease the superheat and clockwise to increase the superheat. When adjusting the valve, make no more than one turn of the stem at a time and observe the change in the superheat closely to prevent overshooting the desired setting. Allow unit to stabilize before taking reading.

(8) When the proper setting is obtained, replace the cap on the valve adjusting stem.

(9) Remove the thermometer or thermocouple probe from the suction line, and replace the insulating material. Close the suction service valve, remove the pressure gage, and install the cap on the service valve gage port. Install the left louvered panel on the condenser section.

b. Replacement.

Table 5-1. Pressure-Temperature Relationship of Saturated Refrigerant 12

Temperature		Pressure		Temperature		Pressure	
Deg F	Deg C	psig	kg/cm²	Deg F	Deg C	psig	kg/cm²
10	-12.3	14.64	1.029	66	18.9	65.03	4.572
12	-11.1	15.84	1.113	68	20.0	67.58	4.751
14	-10.0	17.08	1.200				
16	-8.9	18.36	1.291	70	21.1	70.19	4.934
18	-7.8	19.68	1.384	72	22.2	72.86	5.122
				74	23.3	75.60	5.315
20	-6.6	21.04	1.479	76	24.4	78.39	5.511
22	-5.5	22.44	1.578	78	25.6	81.25	5.712
24	-4.3	23.88	1.679				
26	-3.4	25.36	1.783	80	26.7	84.17	5.917
28	-2.2	26.88	1.890	82	27.8	87.16	6.127
				84	28.9	90.22	6.342
30	-1.1	28.45	2.000	86	30.0	93.34	6.562
32	0	30.06	2.113	88	31.1	96.53	6.786
34	1.1	31.72	2.230				
36	2.2	33.42	2.349	90	32.2	99.79	7.015
38	3.3	35.17	2.472	92	33.3	103.12	7.249
				94	34.5	106.52	7.488
40	4.4	36.97	2.599	96	35.6	110.00	7.733
42	5.5	38.82	2.729	98	36.7	113.54	7.982
44	6.6	40.71	2.862				
46	7.7	42.66	2.999	100	37.8	117.16	8.236
48	8.8	44.65	3.139	102	38.9	120.86	8.496
				104	40.0	124.63	8.761
50	10.0	46.70	3.283	106	41.1	128.48	9.032
52	11.1	48.80	3.431	108	42.2	132.41	9.308
54	12.2	50.95	3.582				
56	13.3	53.16	3.737	110	43.3	136.41	9.590
58	14.5	55.42	3.896	112	44.4	140.49	9.874
				114	45.6	144.66	10.170
60	15.6	57.74	4.019	116	46.7	148.91	10.468
62	16.7	60.11	4.226	118	47.8	153.24	10.773
64	17.8	62.54	4.397				

WARNING

Disconnect power from the air conditioner before performing maintenance on internal components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the right side and back panels.

(3) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(4) Slit the tape and insulation on the suction line enough to loosen the clamp and remove the thermal bulb.

(5) Loosen the flare nuts and remove the expansion valve.

c. Installation.

(1) Position the expansion valve and tighten the flare nuts connecting the tubing to the expansion valve.

(2) Slip the thermal bulb into the clamp on the suction line. Make sure that bulb makes good contact with the suction line. Tighten clamp and tape insulation back in place.

(3) Leak test the valve and newly connected tubing in the area of the valve in accordance with paragraph 5-3b.

(4) Evacuate the system in accordance with paragraph 5-3c.

(5) Charge the system in accordance with paragraph 5-3d.

(6) Install the right side and back panels.

(7) Connect power to the unit.

5-14. EVAPORATOR COIL

See paragraph 4-47 for inspection/test of installed items and cleaning.

a. Repair or replacement. See figure 4-33. If the inspection/test results indicate only a leak in a return bend or tube connection, perform only those steps necessary to repair the defect and skip to step b-7.

WARNING

Disconnect power from the air conditioner before performing maintenance on electrical components. The voltage used can be lethal.

(1) Disconnect power.

(2) Remove the following outside panels: front, right side, lower left side back, bottom and hood.

(3) Release the 1/4 turn fasteners and carefully pull the control panel out far enough to gain access to back of control panel.

(4) Loosen the screws holding the thermostat sensing bulb clamps and remove the sensing bulb from the clamps.

(5) Carefully pull the sensing bulb from around the end of the evaporator coil and tape it to the top of the control panel.

(6) Pull the control panel out of the way, taking care not to damage the harness or the damper control cable.

(7) If the heaters have been in operation, let the unit cool down.

(8) Tag and disconnect the electrical leads to the heater and thermostat.

(9) Remove four each screws and lock washers and remove the heater and thermostat assembly.

(10) Slide the air filter up and out of the side clips on the coil.

(11) Release the refrigerant in accordance with instructions in paragraph 5-3a.

(12) Debraze the suction line from the evaporator and both lines to the half couplings, in accordance with the instructions in paragraph 5-3e.

(13) Disconnect the flare nut from the expansion valve.

(14) Remove four flat head screws and carefully remove the drain pan from the unit.

(15) Remove two screws and remove the two sheet metal thermostat bulb clamps.

(16) Remove four flat heat screws and carefully rotate the evaporator coil and remove the coil from the bottom of the unit. Retain the old coil to use as a sample for forming of distributor lines and location of insulated surfaces. The distributor and flare nut assembly are to be reused.

b. Installation. See figure 4-33.

(1) Coat the mating surfaces of the coil and insulation with adhesive. Let both surfaces air dry until the adhesive is tacky but will not stick to the fingers. See figure 4-33 and old coil for location of insulated surfaces.

(2) Starting with an end, carefully attach the insulation to the metal. Press to a firm contact all over.

(3) Carefully form the distributor lines using the old coil as a sample.

(4) Remove the distributor and flare nut assembly from the old coil and braze to distributor lines in accordance with paragraph 5-3e.

(5) Carefully position the evaporator coil through the bottom of the unit and attach it to the frame with four flat head screws.

(6) Fit the removed lines to the connections on the evaporator coil and the half couplings.

(7) Braze the line joints in accordance with instructions in paragraph 5-3e.

(8) Connect the flare nut to the expansion valve.

(9) Leak test the refrigeration piping in the area of the newly assembled joints in accordance with paragraph 5-3b.

(10) Evacuate the system in accordance with paragraph 5-3c.

(11) Charge the system in accordance with paragraph 5-3d.

(12) Carefully slide the filter into the side clips located on the upper side of the evaporator coil.

(13) Install the two sheet metal thermostat bulb clamps using two screws.

(14) Install the drain pan using four flat head screws.

(15) Carefully mount the heater assembly to the evaporator coil flange using four each screws and lock washers.

(16) Connect the electrical leads. Refer to the tags added when wires were removed and see the wiring diagram, figure 4-7.

(17) Carefully form the sensing bulb capillary line around the end of the evaporator coil and install the bulb in the clamps and tighten the screws.

(18) Reposition the control panel and engage the 1/4 turn stud fasteners.

(19) Install the hood front, right side, lower left side, back and bottom panels.

(20) Connect power to the unit.

5-15. FRAME (BOTH SECTIONS)

See paragraphs 4-30 and 4-48 for access, inspection of installed items, and installation of outside panels.

a. Repair.

(1) Straighten all bent, twisted or dented frame members using conventional sheet metal repair methods.

(2) Repair and reweld all cracked or broken welds.

CAUTION

Take care not to damage any components, wiring or piping when making repairs on frame.

b. Painting. Should touch up or refinishing be necessary, see TM43-0139.

APPENDIX A

REFERENCES

A-1.	**FIRE PROTECTION**	
	TB 5-4200-200-10	Hand Portable Fire Extinguishers Approved for Army Users
A-2.	**LUBRICATION**	
	C91001L	Fuels, Lubricants, Oil and Waxes
A-3.	**PAINTING**	
	TM 43-0139	Painting Instructions for Field Use
A-4.	**MAINTENANCE**	
	TM 38-750	The Army Maintenance Management System (TAMMS)
	TM5-4120-362-23P	Organizational and Direct Support Maintenance Repair Parts and Special Tools List
A-5.	**CLEANING**	
	Fed. Spec P-D-680	Dry cleaning solvent
A-6.	**DESTRUCTION**	
	TM 750-244-3	Procedures for Destruction of Equipment to Prevent Enemy Use
A-7.	**SHIPMENT AND STORAGE**	
	TM 740-90-1	Administrative Storage of Equipment
A-8.	**RADIO SUPPRESSION**	
	TM 11-483	Radio Interference Suppression

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I

INTRODUCTION

B-1. General

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance functions.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions on explanatory notes for a particular maintenance function.

B-2. Maintenance Functions

a. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination.

b. **Test.** To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. **Service.** Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. **Adjust.** To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. **Aline.** To adjust specified variable elements of an item to bring about optimum or desired performance.

f. **Calibrate.** To determine and cause corrections to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. **Install.** The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. **Replace.** The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. **Repair.** The application of maintenance services (inspect, test, service, adjust, aline, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item, or system.

j. **Overhaul.** That maintenance effort (services/actions) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. **Rebuild.** Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipments/-components.

B-3. Column Entries

Columns used in the maintenance allocation chart will be limited to those shown. Entries for those columns are explained below.

a. **Column 1, Group Number.** Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. **Column 2, Component/Assembly.** Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. **Column 3, Maintenance Functions.** Column 3 lists the functions to be performed on the item listed in column 2. (For detailed explanation of these functions, see paragraph B-2.)

d. **Column 4, Maintenance Level.** Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform the maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance levels, appropriate "work time" figures will be shown for each level. The number of man-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition. The symbol designations for the various maintenance levels are as follows:

C . . . . . Operator or crew
O . . . . . Organizational maintenance
F . . . . . Direct support maintenance
H . . . . . General support maintenance
D . . . . . Depot maintenance

e. **Column 5, Tools and Equipment.** Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. **Column 6, Remarks.** Column 6 contains a letter code in alphabetical order which shall be keyed to the remarks contained in Section IV.

B-4. Column Entries Used in Tool and Test Equipment Requirements

a. **Column 1, Tool or Test Equipment Reference Code.** The tool and test equipment reference code correlates with a maintenance function on the identified end item or component.

b. **Column 2, Maintenance Level.** The lowest level of maintenance authorized to use the tool or test equipment.

c. **Column 3, Nomenclature.** Name or identification of the tool or test equipment.

d. **Column 4, National/NATO Stock Number.** The National or NATO stock number of the tool or test equipment.

e. **Column 5, Tool Number.** The manufacturer's part number.

B-5. Explanation of Columns in Section IV

a. **Reference Code.** The code scheme recorded in column 6, Section II.

b. **Remarks.** This column lists information pertinent to the maintenance function being performed as indicated on the MAC, Section II.

APPENDIX B

Section II

MAINTENANCE ALLOCATION CHART

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level C	O	F	H	D	(5) Tools & Equipment	(6) Remarks
01	ELECTRICAL CABLE AND INTERCONNECTING HOSES								
	Cable Assembly, Interconnecting	Inspect		0.5					
		Test		0.5					
		Repair		1.0					
		Replace		0.2					
	Refrigerant hoses	Test		0.2					
		Replace			0.4				
	Connector Electrical	Test		0.3					
		Repair		0.5					
		Replace		0.5					
02	CONDENSER SECTION								
	Panels, Grilles and Hood	Inspect	0.1						
		Service		0.2					
		Repair		1.0					
	Connector Electrical (Shorting Plug)	Test		0.3					
		Repair		0.5					
		Replace		0.5					
	Electrical Wiring	Test		1.0					
		Repair		1.0					
		Replace		4.0					
	Fuse	Inspect		0.3					
		Replace		0.3					
	Fan, Condenser	Inspect		1.0					
		Replace		1.0					

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level C	O	F	H	D	(5) Tools & Equipment	(6) Remarks
	Motor, Condenser Fan	Test		0.2					
		Replace		1.0					
	Pressure Switch	Test		0.3					
		Replace			8.0				
	Rectifier	Test		0.3					
		Replace		1.0					
	Refrigerant Piping	Test		1.0					
		Repair			8.0				
	Valve, Service	Test		0.2					
		Replace			8.0				
	Coupling Halfs	Test		0.2					
		Repair			8.0				
		Replace			8.0				
	Compressor	Test		0.3					
		Repair			8.0				
		Replace			14.0				
	Capacitors	Test		0.3					
		Replace		1.0					
	Switches Relays	Test		0.3					
		Replace		1.0					
	Sight glass	Inspect		0.3					
		Replace			8.0				
	Drier	Replace			8.0				
	Receiver	Inspect		0.3					
		Replace			8.0				
	Coil, Condenser	Test		1.0					
		Repair			4.0				
		Replace			10.0				
	Frame	Inspect		1.0					
		Repair			4.0				
03	EVAPORATOR SECTION								
	Panels, Grilles and Hood	Inspect	0.1						
		Service		0.2					
		Repair		1.0					

(1) Group Number	(2) Component/Assembly	(3) Maintenance Function	(4) Maintenance Level C	O	F	H	D	(5) Tools & Equipment	(6) Remarks
	Electrical Wiring	Test	1.0						
		Repair	1.0						
		Replace	4.0						
	Switches	Test	0.3						
		Replace	1.0						
	Damper Assembly and Control	Service	0.2						
		Repair	1.0						
		Replace	3.0						
	Fan, Evaporator	Test	1.0						
		Replace	1.0						
	Motor, Evaporator Fan	Test	0.2						
		Replace	1.0						
	Capacitor	Test	0.3						
		Replace	1.0						
	Relay	Test	0.3						
		Replace	1.0						
	Silicon Junction Rectifier	Test	0.3						
		Replace	1.0						
	Refrigerant Piping	Test	1.0						
		Repair							
		Replace							
	Half Couplings	Test	0.2						
		Repair		8.0					
		Replace		8.0					
	Expansion Valve	Test	0.3						
		Adjust		8.0					
		Replace		8.0					
	Air Filter	Service	0.3						
		Replace	0.3	4.0					
				8.0					
	Heating Unit	Test	0.3						
		Repair	0.5						
		Replace	1.0						
	Coil, Evaporator	Test	1.0						
		Repair		8.0					
		Replace		12.0					
	Frame	Inspect	1.0						
		Repair		4.0					

APPENDIX B

Section III.

TOOLS AND TEST EQUIPMENT REQUIREMENTS

(1) Reference Code	(2) Maintenance Level	(3) Nomenclature	(4) National/NATO Stock Number	(5) Tool Number
		No special tools and test equipment required. Standard tools and test equipment in the following kits are adequate to accomplish the maintenance functions listed in Section II:		
		Tool kit, service refrigeration Unit (SC 5180-90-CL-N18)	5180-00-597-1474	
		Soldering Gun Kit	3439-00-930-1638	

APPENDIX B

Section IV.

REMARKS MAINTENANCE ALLOCATION CHART

Reference Code	Remarks
	No supplemental instructions or explanatory remarks are required for the maintenance functions listed in Section II. All functions are sufficiently defined in Section I. Active time listed for maintenance task functions are withthe air conditioner in off-equipment position.

APPENDIX C

EXPENDABLE SUPPLIES AND MATERIALS LIST

C-1. SCOPE

This appendix lists Expendable Supplies and Materials you will need to operate and maintain the Air Conditioner. These items are authorized to you by CTA 50-970, Expendable Items (except Medical Class V, Repair Parts and Heraldic Items).

C-2. EXPLANATION OF COLUMNS

a. **Column 1 - Item Number.** This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material.

b. **Column 2 - Level.** This column identifies the lowest level of maintenance that requires the listed item.

c. **Column 3 - National Stock Number.** This is the national stock number assigned to the item; use it to request or requisition the item.

d. **Column 4 - Description.** Indicates the federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parenthesis, if applicable.

e. **Column 5 - Unit of Measure (UM).** Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation, e.g., each (ea), inch (in), pair (pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) UM
1	F	9150-00-823-7905	Lub. Oil Ref. VV-L-825	GL
2	C	6850-00-264-9037	Dry Cleaning Solvent P-D-680 (81348)	GL
3	F		Dichlorodifluoromethane, Technical w/cylinder 22 lb Refrigerant -12 BB-F-1421, Type 12 (81348)	CY

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General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
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BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARAGRAPH	FIGURE NO.	TABLE NO.
6	2-1 a		
81		4-3	
125	line 20		

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 cylinders. The engine on my set only has 4 cylinders. Change the manual to show 4 cylinders.

Callout 16 on figure 4-3 is pointing at a bolt. In the key to fig. 4-3, item 16 is called a shim. Please correct one or the other.

I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket but it doesn't fit. Supply says I got what I ordered so the NSN is wrong. Please give me a good NSN.

SAMPLE

TYPED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER
JOHN DOE, PFC (268) 317-7111

SIGN HERE:
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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*
inches	centimeters	2.540
feet	meters	.305
yards	meters	.914
miles	kilometers	1.609
square inches	square centimeters	6.451
square feet	square meters	.093
square yards	square meters	.836
square miles	square kilometers	2.590
acres	square hectometers	.405
cubic feet	cubic meters	.028
cubic yards	cubic meters	.765
fluid ounces	milliliters	29,573
pints	liters	.473
quarts	liters	.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	.454
short tons	metric tons	.907
pound-feet	newton-meters	1.365
pound-inches	mewton-meters	.11375

To change	*To*	*Multiply by*
ounce-inches	newton-meters	.007062
centimeters	inches	.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	.621
square centimeters	square inches	.155
square meters	square feet	10.764
square meters	square yards	1.196
square kilometers	square miles	.386
square hectometers	acres	2.471
cubic meters	cubic feet	35.315
cubic meters	cubic yards	1.308
milliliters	fluid ounces	.034
liters	pints	2.113
liters	quarts	1.057
liters	gallons	.264
grams	ounces	.035
kilograms	pounds	2.205
metric tons	short tons	1.102

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

PIN : 047479-000